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OSTEOPOROSIS AND FRACTURES AMONG PEOPLE AGED 65 AND OVER: RECOMMENDATIONS FOR AN INTEGRATED FRAMEWORK FOR ACTION IN QUÉBEC

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and contributors

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MISSION

To support the *Ministre délégué à la Recherche, à la Science et à la Technologie* and Québec's public health system decision-makers, including the *Ministère de la Santé et des Services sociaux*, through the assessment of technologies and methods of intervention in health issues, notably the assessment of their efficacy, safety, cost and cost-effectiveness, as well as ethical, social and economic implications.

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OSTEOPOROSIS AND FRACTURES AMONG PEOPLE AGED 65 AND OVER: RECOMMENDATIONS FOR AN INTEGRATED FRAMEWORK FOR ACTION IN QUÉBEC

Osteoporosis is caused by gradual bone loss associated with age. According to estimates, half of Canadian women over the age of 75 suffer from low bone density and are at risk for fractures of the wrist, hip and spine. It is a major health problem that has numerous organizations around the world reviewing their screening, diagnosis and treatment strategies, as well as recommending structured action plans to deal with this illness.

As part of its involvement in reviewing national health-care priorities, the Direction de la santé publique de Montréal-Centre asked AÉTMIS to conduct a thorough study of the recommendations available. AÉTMIS's research provides a starting point for recommendations on an integrated framework for action to fight osteoporosis and fragility fractures in Québec.

The authors have based their review on the analysis of 11 reports prepared by national and international organizations. Conclusions emphasize the need for a framework that integrates and appropriately sets out population-related and clinical interventions. The implementation of this plan will require leadership at the ministerial level and the involvement of many stakeholders from different fields.

AÉTMIS also recommends the development and assessment of various ways to identify people at risk, promote good health care among the young and prevent falls among people aged 75 and over. Other recommendations highlight the need to develop and implement a guide to good clinical practices, and to assess its application. The guide must be updated to include any developments in the evidence available. A recommendation was also made regarding the priority to be given to research in this area.

With this assessment, *AÉTMIS* wishes to provide the best possible information to the policymakers at various levels of the Québec health services network concerned by the important public health problem that is osteoporosis.

Renaldo N. Battista
President and CEO

SUMMARY

Introduction and objective

Osteoporosis is caused partly by the gradual loss of bone mineral density associated with age. According to estimates, this condition strikes a third of Canadian women over the age of 65 and half over the age of 75. Low bone density is a major risk factor for fractures of the wrist, hip and spine. The mortality rate in the year following a hip fracture ranges from 12% to 20%, while the disability rate among survivors stands at 25%. However, the impact of these complications exceeds the aspects that are usually measured. For example, in a study, 80% of women aged 75 and over said that they would rather die than suffer a hip fracture. The impacts that physical disabilities have on quality of life have not been adequately studied and, as a result, are neglected in official assessments and recommendations.

The decrease in bone density that is characteristic of osteoporosis, combined with other factors, also increases the risk of fractures. The Québec population, for example, is systematically exposed to genetic, climatic and environmental risk factors that contribute to the prevalence of fractures.

The objective of this study is to summarize the various reports published worldwide on osteoporosis screening, in order to 1) describe the recommendations and supporting arguments; 2) understand the differences between the recommendations in order to prepare a coherent summary; 3) make recommendations for an integrated framework for action against osteoporosis and fragility fractures in Québec.

Bone densitometry

Densitometry measures the mineral content of the skeleton, which gives an estimate of bone fragility and involves the use of various X-ray or ultrasound techniques. At the international level, in spite of unanimous recommendations against the use of densitometry for population-wide screening, all industrialized countries have reported a sharp increase in the number of tests conducted. The number of tests conducted in Ontario grew sixfold between 1992 and 1998, to one in seven women aged 55 to 69. Since the geographic distribution of screening is determined solely by market laws, the highest number of tests was observed to be 200 times more than the lowest. There is no published information available on the use of densitometry or on the prevalence of osteoporosis in Québec.

Still at the international level, the recommendations fail to agree on a definition of people at risk who should be tested for osteoporosis. These differences stem from a lack of understanding of the paradigms used and the objectives sought. The clinical paradigm, on one hand, favours diagnosing and treating osteoporosis in consulting patients. The use of densitometry therefore depends on the reasons for the consultation and the prescribing of the test. In the Ontario survey, most of the cases were patients consulting their general practitioners about issues relating to menopause.

The public health paradigm, on the other hand, has a broader objective: fighting osteoporosis and fractures. In this context, densitometry is presented as the tool that could be useful to people between the ages of 65 and 75 who were already identified because of other risk factors. Three of these risk factors — a previous fragility fracture, physical inactivity and a low body mass index — are deemed especially interesting, as they are linked to both osteoporosis and fractures.

Lastly, cost-benefit considerations, the level of awareness among clinicians and the general

public, as well as the organization of health-care services differ from country to country. We therefore need to base our arguments on data that correspond to our reality.

Conclusions of the review

It is difficult to summarize the recommendations on osteoporosis screening and the prevention of fragility fractures, as they are indistinguishably based on two models: one favours clinical management and the second, a public-health-type prevention approach. As a means of preventing fragility fractures, the two models are not incompatible; however, the reports do not clearly demonstrate their complementarity. This is partly due to the fragmentation of disciplines and the fact that prevention and treatment objectives are not clearly defined.

Based on the evidence, none of the 11 reports studied recommends universal bone density screening, i.e. among individuals who present no symptoms of osteoporosis and do not request the test. They also do not recommend bone densitometry for risk-free patients seeking medical attention, whether or not they request the test. In spite of these recommendations against intervention, no alternative strategies are put forward for the general public. One aspect that is sometimes alluded to is population-wide screening for risk factors associated with fragility fractures.

The reports studied differ on the use of bone densitometry to screen people who, when consulting, present one or more risk factors for osteoporosis or fragility fractures. Although several of the reports agree that the practice could be recommended, they differ on the number and definition of the risk factors. None of the organizations used the prevalence of risk factors among their local populations as a basis for their recommendations. They seem to focus more on the clinicians' need to face the growing demand.

All the recommendations present osteoporosis as a major health-care issue. The research conducted has focused primarily on imagery techniques and pharmacology, rather than on integrated strategies to fight osteoporosis and fragility fractures, even though there is no direct evidence that these techniques are effective. Although it is virtually not addressed in the reports studied, the imbalance — in part caused by the differences in funding capabilities — sometimes reduces the scope of thought on the fight against fragility fractures to the single question of bone densitometry or hormone replacement therapy.

Recommendations

The following recommendations are aimed at initiating a process that will help prevent fragility fractures by fighting against osteoporosis and risk factors associated with osteoporosis and fractures. Although the recommended approaches and interventions largely apply to women, they also extend to men who, to a lesser extent, may present several of the risk factors, as well as young people. These recommendations are formulated as objectives to be met.

The reports studied for this project clearly demonstrate the need for a framework that integrates and appropriately sets out population-related and clinical interventions. The implementation of this plan will require leadership at the ministerial level and the involvement of many stakeholders with different interests, especially institutions in the health-care and social services network, non-profit organizations that focus on promoting physical activity or healthy eating for example, seniors groups. as well as private pharmaceutical or biomedical engineering companies. Although the cost of implementing such a plan has yet to be determined, it would probably be modest compared with the costs incurred by the exponential increase in the availability and use of diagnostic and treatment methods for osteoporosis, which is driven by those having vested interests.

Recommendation 1

An integrated framework for action should be created to fight osteoporosis and fragility fractures in Québec.

Recommendation 2

Measures should be introduced, and assessed, to raise awareness among and to identify Québecers at risk for osteoporosis and fragility fractures.

Recommendation 3

Guidelines for good clinical practices should be developed, implemented and assessed. They should be updated to take into account new evidence on:

- *The identification of patients seen in primary care at risk for fragility fractures as a result of low bone mass (previous or family history of fragility fractures, low body mass index, estrogen-related problems, etc.);*
- *The identification of people with a high risk for falls and, by extension, for fragility fractures (previous history of falls, social isolation, people on multiple medications, etc.);*
- *Diagnostic indications for bone densitometry and interpretation of results;*
- *Quality control criteria for all aspects of the installation, use and replacement of bone densitometry equipment as technology progresses;*
- *Management of previously identified people, including drug therapy for osteoporosis and referrals to health-care or social services depending on the type of risks identified.*

Recommendation 4

Public health interventions should be introduced and assessed with a view to promoting the development of strong bones among adolescents and to preventing falls among people aged 75 and over.

Recommendation 5

Support for the research required to assess actions against osteoporosis and fragility fractures in Québec should be increased.

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1. PREAMBLE

Osteoporosis is a medical condition that is making headlines in the scientific community and the news media. In the past 15 years, several agencies as well as professional and patient groups have expressed their opinions on osteoporosis screening and treatment. The constant increase in technological and pharmacological research and innovations in this field is raising questions and calling for decisions on the screening, diagnosis and treatment of osteoporosis.

Published recommendations do not always clearly outline the reason for identifying and treating osteoporosis — to reduce the harmful effects of the disease. The principal effects are fragility fractures (hip, wrist and vertebrae) and the psychosocial stigmas associated with this silent condition, as well as its daunting impact on patients' autonomy.

Our perusal of the recommendations on osteoporosis revealed significant differences in how the problem is perceived, and disagreements on what should and should not be done, as well as inherent contradictions in the arguments used to support the recommendations (Marshall *et al.*, 1997).

Neither Québec's Ministère de la Santé et des Services Sociaux nor its regional health boards have adopted an official position on osteoporosis. However, over the past several years, the public health departments and the Association des radiologistes du Québec [Québec association of radiologists] have suggested that studies be conducted in order to adapt recommendations to the Québec context. Several of the province's clinicians were involved in recent studies presented at the Canadian Consensus Conference on Menopause and Osteoporosis sponsored by the Society of Obstetricians and Gynaecologists of Canada (Rowe *et al.*, 1998). Osteoporosis Québec, a major patient group, is also focusing on educating and helping women and men of all ages prevent and fight osteoporosis. The principal objective of the organization, which uses Internet to reach its target population, is to encourage Québecers to reduce their chances of developing osteoporosis by building a healthy bone mass. None of Québec's current initiatives on osteoporosis or fragility fractures were evaluated.

This problem could not be overlooked by the various decision-makers and parties involved in reviewing the priorities of Québec's public health program. As part of its active involvement in the process, the Direction de la santé publique de Montréal-Centre [Montréal-Centre department of public health] called on AÉTMIS to conduct a thorough study of the recommendations available worldwide on the methods for preventing osteoporosis and fragility fractures.

2. OBJECTIVE AND METHODOLOGY

The objective of this study is to summarize reports published worldwide on osteoporosis screening in order to:

- Describe the recommendations and supporting arguments;
- Understand the differences in the recommendations so as to produce a coherent summary;
- Make recommendations for an integrated framework for action against osteoporosis and fragility fractures in Québec.

Our methodology consisted of using Internet search engines and *Medline* to gather reports on osteoporosis screening. The following inclusion criteria were applied:

- Material published after 1995;
- Coverage of the Western world with particular attention to Canadian publications, even if dated prior to 1995;
- Documentation in either English or French;
- Material published by agencies receiving funding from public or parapublic sources.

We limited our review to reports published after 1995 (except one Canadian report) because advances in technology and pharmacology since 1995 have completely changed the approach to prevention and treatment. In addition, a review covering the period from 1986 to 1995 has already been published (Marshall *et al.*, 1997).

Our methodology consisted in *textually* transcribing the recommendations and supporting arguments (see Appendix) of the reports reviewed. To facilitate understanding and comparison of the reports, the information was the information was, from the start, organized according to plan using epidemiological criteria to study screening technologies (Table 1) (Spasoff, 1999). The criteria were classified under four categories: the disease, the screening test, treatment and prevention, and the development of a screening program. Section 3 of this report contains a summary of the arguments provided under these four categories in the appendix. The arguments are followed by a comparison of the report recommendations. This summary was prepared with the least amount of interpretation possible; as a result, some of the information may appear inconsistent, even contradictory.

Recommendations on bone density screening are presented in Table 4 while those on the prevention and treatment of osteoporosis, as well as fragility fractures, are detailed in Table 5. The data are presented according to the population targeted for screening or intervention in order to facilitate comparison.

Section 4 discusses limitations in interpreting the results In addition to making a distinction between diagnosis and screening, it addresses the key concept to understanding the role of densitometry in the fight against osteoporosis and fragility fractures. Lastly, the results are interpreted in Sections 5, 6 and 7 with a view to making recommendations for Québec.

Table 1: Categories for classifying arguments on osteoporosis screening

1. The disease - Severity, mortality, morbidity - Frequency, prevalence - Importance in public opinion - Economic burden - Detectable pre-morbid stage - Modifiable natural history	**2. The test** - Sensitivity, specificity, predictive values - Reproducibility - Safety - Availability, accessibility, simplicity, eligibility - Effectiveness
3. Treatment/Prevention - Efficacy, efficiency - Availability - Safety, tolerance - Accessibility, eligibility, compliance with treatment	**4. Screening/development program** - Efficacy, efficiency - Population/patients reached - Social ethical issues - Professional aspects of health - Organization of health care services

3. RESULTS

Of the 11 reports reviewed, three were published by international agencies, four were from Europe, two from the United States and two from Canada. The list of agencies (as well as acronyms used in the text) is provided in Table 2.

The reports contain recommendations on six different issues: screening and diagnostic densitometry, hormone replacement therapy, other drugs and non-pharmacological methods of preventing and treating osteoporosis as well as preventing falls among people aged 65 and over (see Table 3). All the reports address the issue of densitometry, but are not consistent in tackling the remaining aspects. Five of the 11 reports (WHO, European Commission, U.S. NIH, INSERM and the U.K. Department of Health) cover all the areas. The report from the U.S. Agency for Healthcare Research and Quality, which is scheduled for publication in the second half of 2001 and for which only a summary was available, was not included in this report.

Table 2: Reports used to summarize recommendations on osteoporosis screening

International

- Organisation mondiale de la santé World Health Organization (WHO, OMS) Task Force for Osteoporosis (Genant *et al.*, 1999 – interim report)
- International Network of Agencies for Health Technology Assessment (INAHTA) (Hailey *et al.*, 1996, 1998)
- European Commission, Employment and Social Affairs Directorate-General (Agnusdei *et al.*, 1999)

North America

- Canadian Task Force on the Periodic Health Examination (Feig, 1994)
- British Columbia Office for Health Technology Assessment (BCOHTA) (Green 1997)
- National Institutes of Health (U.S. NIH). (U.S.A., National Institutes of Health, 2001)
- U.S. Preventive Services Task Force (Wallace *et al.*, 1996

Europe

- Catalan Agency for Health Technology Assessment (Espallargues, 1999)
- UK Department of Health and Royal College of Physicians (UK Department of Health, 1999)
- Swedish Council on Technology Assessment in Health Care (Ringertz *et al.*, 1997)
- Institut national de la santé et de la recherche médicale (INSERM, France) (Alexandre *et al.*, 1996)

Six of the reports clearly indicated the quality criteria used to analyze the evidence, three seemed to be based solely on the type of study and another on a pertinence criterion (Table 3). It was difficult to determine the methodology used in some of the reports.

Table 3: Description of reports reviewed

	Areas covered						Methodology			Reference
	Densitometry[1]		Prevention/treatment of osteoporosis[2]			Prevention of falls				
Agency Country Year	Scr.	Diag.	HRT	Other Rx	Non-Rx approach		Pertinence of studies	Types of studies	Quality criteria	
WHO[3] 18 countries, 1999	√	√	√	√	√	√	?	?	?	Genant *et al.*, 1999
INAHTA[4] 10 countries, 1996	√		√	√			√	√	√	Hailey *et al.*, 1996
European Commission 15 countries, 1999	√	√	√	√	√	√	√			Agnusdei *et al.*, 1999
Canadian Task Force, Canada, 1993	√		√			√	√	√	√	Feig, 1994
BCOHTA[5] Canada, 1997	√		√			√	√	√	√	Green, 1997
Preventive Services Task Force, U.S., 1996	√		√	√	√		√	√	?	Wallace *et al.*, 1996
National Institutes of Health, U.S., 2001	√	√	√	√	√	√	√	√		NIH, 2001
INSERM[6] France, 1997	√	√	√	√	√	√	√	√		Alexandre *et al.*, 1997
UK Dept. of Health, Great Britain, 1999	√	√	√	√	√	√	√	√	√	UK Dept. of Health, 1999
Swedish Council Tech. Ass., Sweden, 1997	√	√			√		√	√	√	Ringertz *et al.*, 1997
Catalan Agency Health Tech. Ass., Spain, 1999	√	√			√	√	√	√	√	Espallargues *et al.*, 1999

1 Bone densitometry: diagnosis (diag.) or screening (scr.).
2 Hormone replacement therapy (HRT), other pharmacological (Rx) and non-pharmacological approaches (non-Rx).
3 WHO = World Health Organization, Interim Report.
4 INAHTA = International Network of Agencies for Health Technology Assessment.
5 BCOHTA = British Columbia Office for Health Technology Assessment.
6 INSERM = Institut national de la santé et de la recherche médicale.

3.1 SUMMARY OF DISCUSSIONS ON THE DISEASE AND APPROACH PHILOSOPHIES

To help understand the content and scope of the recommendations made in the reports studied, we must first outline the method used to define the problem itself. Osteoporosis and fragility fractures are defined based on philosophies that are not only different, but in some cases, poles apart. The issue is tackled from three different angles. In one instance, the condition is defined essentially using bone density as a marker for fracture risk. The WHO is a leading proponent of this viewpoint and goes so far as to propose a diagnostic threshold value. Three other reports concur with this concept, albeit with some variations (U.K. Department of Health, Swedish Council and the U.S. Preventive Services Task Force). The BCOHTA is at the opposite end of the spectrum; it espouses a completely different ideology and argues that osteoporosis is not a disease but a natural part of the aging process. It therefore addresses the importance of fragility fractures as an issue separate from osteoporosis.

Between these two extremes, there are four reports that present osteoporosis and fragility fractures in a more global context (U.S. NIH, INSERM, European Commission, Catalan Agency). They define osteoporosis as a negative result of a lifetime's accumulation of bone capital, minus loss due to aging (Type II) or menopause (Type I). According to these reports, bone mass depends on a combination of genetic, physiological, environmental and behavioural factors that have varying levels of influence throughout life. The risk for fragility fractures is described as an interaction between osteoporosis and the physical and social environments. The INAHTA report combines the WHO's clinical definition with the systemic approach of the European Commission. The report submitted by the Canadian Task Force does not take a stance on the definition of osteoporosis.

Two attitudes emerge from these approaches to the definition of the problem. On the one hand, the clinical model provides a definition of osteoporosis that stretches from screening to diagnosis to treatment (Figure 1)

Each of the three parameters is defined on an operational basis. The scientific arguments are based on clinical practice and consider bone

Figure 1: Clinical model of osteoporosis screening

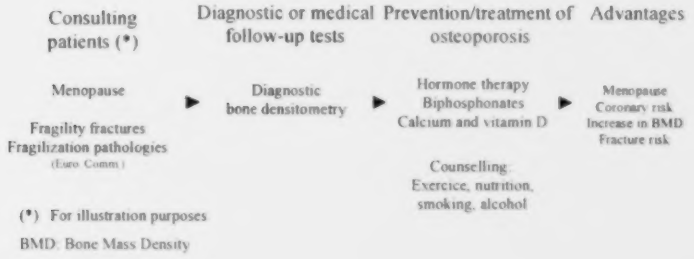
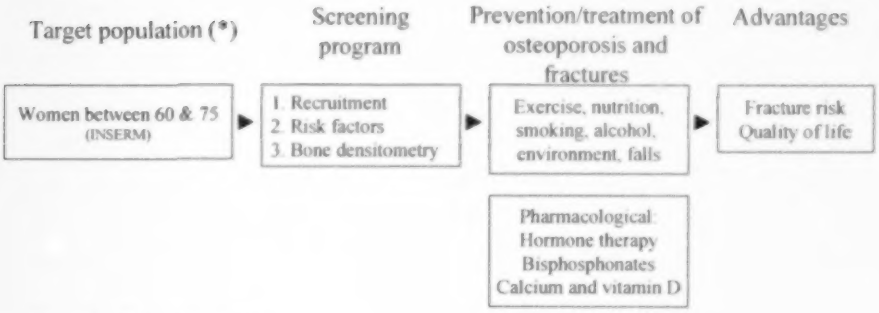


Figure 2: Public health model of osteoporosis screening



(*) For illustration purposes

densitometry as key to obtaining the clinical and pharmacological resources for prevention and treatment. This process is based on information obtained from perimenopausal women, who are already consulting with their physicians and are also the most sought-after for research purposes.

On the other hand, where the target population group is larger, interventions go beyond the clinical framework and target fracture risk exclusively (Figure 2).

Although bone density screening itself is an important element, it is also combined with other prevention strategies. The target population group is larger, and neither the population nor the interventions proposed are sufficiently well defined to be operational. Even the risk factors, which are the key elements in this type of presentation, are merely listed.

Lastly, the various reports agree on the fragility fracture figures used to justify screening for and treating osteoporosis. According to estimates, 15% of women and 5% of men will suffer a hip fracture in their lifetime. The excess mortality among those who have suffered a hip fracture ranges from 12% to 20% and the prevalence of long-term dependence is approximately 25%.

3.2 SUMMARY OF ARGUMENTS ON BONE DENSITOMETRY SCREENING

Double energy x-ray absorptiometry is the most widely used and studied technology. The reports unanimously agree that the technique measures bone density with a precision (coefficient of variation for random error) reported between 1% and 3%, and accuracy (coefficient of variation for systematic error) reported between 2% and 10%; it is low-risk and is completed in a few minutes. Two reports stress the rapid advances in densitometry technology, especially with the introduction of the quantitative ultrasound (QUS) of the heel as a screening test that is more financially and technically accessible (U.S.

Preventive Task Force and U.S. NIH). However, the predictive values of the heel ultrasound are not expected to exceed the best currently obtained with X-ray technology. These techniques measure bone mineral content and not bone architecture, which is important to determining bone strength.

There is a consensus that bone density measurements are poor predictors of fracture risk; sensitivity is rated between 30% and 50%, specificity between 80% and 90% and predictive value at only 50% in the best-case scenarios (INAHTA). These disappointing results are sometimes presented in terms of their dose-response relationship or relative risks, thereby portraying the tests as significantly more effective. For example, the findings of Cummings *et al.*, 1995, that osteoporotic women have a more than 2.0 relative risk for hip fractures, is often quoted. The description of the relationship between osteoporosis and fractures is often compared to that of hypertension and a stroke. Only one report clearly links the sensitivity and specificity of the test, on the one hand, and the incidence of osteoporosis among the various age groups on the other (INSERM). It concludes that bone densitometry prior to age 60 and after age 75 is useless. The WHO report also refers to age, indicating 65 as the optimal age for screening.

All the reports agree that the weakness in the bone densitometry test is the lack of reliability (reproducibility) in the field. This can be attributed in part to variations in the instrumentation and calibration, methods of use and the identification of anatomical marks, the interpretation of the results (different ways of reporting the results and lack of uniformity in the threshold values). This problem is real and probably varies from one location to the next.

Most of the reports agree that the predictive value of the test and the cost-benefit ratio could be improved if risk factors (such as those mentioned in Figure 3) are used to identify patients who could best benefit from the technique without necessarily eliminating the high number of false positives and false negatives. However, all but one of the reports failed to identify specific factors that could improve the performance of the test, and the only one that did (the Catalan Agency) did not demonstrate how or to what extent. One report highlighted the history and physical examination of the patient as essential components in evaluating fracture risks (U.S. NIH). Another report stated that densitometry is useful for identifying women who may benefit from hormone replacement therapy and who cannot be identified otherwise (U.S. Preventive Services Task Force).

With regard to frequency of examinations, since osteoporosis develops slowly (favourably or not) it is not necessary to repeat the tests at intervals of less than two years (Swedish Council).

Three arguments once again undermine the use of densitometry (BCOHTA). First, there apparently is no proof that bone density influences physicians' prescribing patterns. Secondly, it has been demonstrated that patients diagnosed with osteoporosis become less physically active (protective behaviour), thereby worsening one of the risk factors — physical inactivity. Lastly, a report raises the potentially significant impact of the false reassurance created by a negative bone density test, given the considerable number of false negative results obtained with this test (low sensitivity) (U.S. Preventive Task Force).

3.3 SUMMARY OF RECOMMENDATIONS ON BONE DENSITOMETRY SCREENING

The reports provide recommendations on bone density screening for three segments of the population: the general public, perimenopausal women and patients at risk (Table 4).

Figure 3: Theoretical model for preventing fractures among people aged 65 and over

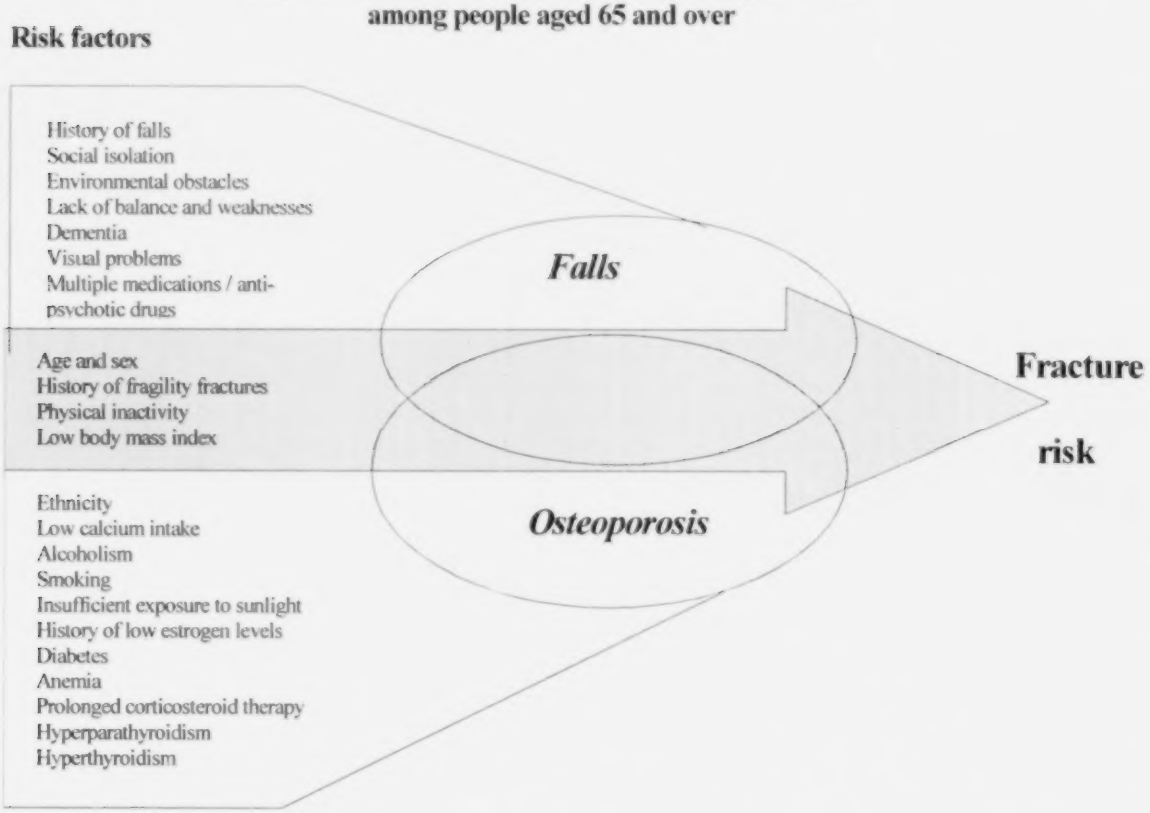


Table 4: Summary of recommendations on bone densitometry screening

Source	Target population	Screening	Recommendation
World Health Organization, 1999 (interim report)	General population aged 65 Physicians Health authorities – for individuals at risk	Screening in the broad sense Use bone densitometry when available Facilitate access to bone densitometry and ensure quality control of systems	*Strategy based on clinical considerations* *Make use* *Facilitate access* *Ensure quality control*
INAHTA, 1996	Menopausal women or selected groups (*opportunistic*)	Bone densitometry in combination with hormone replacement therapy	*Does not support screening for the prevention of fractures – not encouraging about potential effectiveness*
European Commission, 1999	Perimenopausal women General population, regardless of age group People who present recognized clinical criteria	Bone densitometry Bone densitometry Bone densitometry	Not recommended Not justifiable Access to and refunds for these exams
Canadian Task Force, 1993	General female population	Bone densitometry with a view to prescribing hormone replacement therapy	*Not recommended at the moment*
BCOHTA, 1997	General female population	Bone densitometry, regardless of the technology used, including ultrasound	*Unsuitable to change clinical course of fragility fracture*
U.S. Preventive Task Force, 1996	Postmenopausal female population Women at high risk for osteoporosis or fractures	Bone densitometry Densitometry with a view to using hormone replacement therapy	*Insufficient evidence to recommend for or against – recommendation against may be made on other grounds* *May be appropriate to assist treatment decisions to prevent osteoporosis*
U.S. NIH, 2001	Perimenopausal women Patients at a high risk for osteoporotic fractures (glucocorticoids, etc.)	Bone densitometry Bone densitometry followed by a treatment to prevent osteoporotic fractures	*Value not established* *Should be considered when it will help the patient decide*

Source	Target population	Screening	Recommendation
INSERM, 1996 – 1997	Women aged 45 to 55	Systematic screening for osteoporosis	Does not appear useful at present
	Women aged 60 to 75 - Who have a fracture after a non-serious fall	--- considered osteoporotic until proven otherwise	---
	- With a family history of fractures and treatment susceptible to increase bone loss	Bone mass measurement	Could help determine later treatment
	- Without any apparent or identifiable risk factors	Screening for osteoporosis with a view to a preventive treatment for fractures	Could be considered
	Women aged 75 and over	--- half are osteoporotic	---
UK Department of Health, 1999	General public versus patients identified with fragility fractures or who have strong risk factors	Bone densitometry by double energy X-ray absorptiometry	*Recommends the use in the context of a case-finding strategy rather than for population screening – Health Authorities: purchase equipment and give opportunity to access*
	Post-menopausal women	Other densitometry techniques, including ultrasounds	*Does not recommend the use for diagnosis but does not preclude the use in risk assessment*
		Bone densitometry	*Should not institute mass population screening*
Swedish Council Technology Assessment, 1997	General population, post-menopausal women and patients who present no symptoms of osteoporosis	Bone densitometry	*Scientific evidence insufficient to recommend*
	Patients with vertebral fractures or diseases that increase the risk for fractures or osteoporosis, or that are being treated for osteoporosis	Bone densitometry	*May be indicated . . . should include factors other than bone density alone*

Source	Target population	Screening	Recommendation
Catalan Agency for Health Technology Assessment, 1999	General population, including menopausal women	Bone densitometry	*Scientific evidence insufficient to recommend*
	Individuals with a high fracture risk	Bone densitometry	*More appropriate in these groups. Clinical utility . . . in these groups should be determined*

Four reports make a clear recommendation for universal screening for people who are either asymptomatic or have no known or identifiable risk factors for osteoporosis. Two of the reports clearly recommend against using bone densitometry as a result of its low predictive value for fracture risk (European Commission and UK Department of Health). The Swedish Council and Catalan Agency do not take a stance on this issue, claiming a lack of scientific evidence.

Of the 10 reports that deal with the issue of screening perimenopausal or postmenopausal (early) women, six do not recommend such a measure (INAHTA, Canadian Task Force, BCOHTA, European Commission, INSERM and UK Department of Health) and four remain neutral, due to a lack of scientific evidence (U.S. Preventive Task Force, U.S. NIH, Swedish Council and Catalan Agency). Of the six that recommend against osteoporosis screening, two link screening and hormone replacement therapies (INAHTA and Canadian Task Force) and one studies screening in a context that goes beyond bone densitometry (INSERM).

With regard to the screening of patients or clients, the reports offer different definitions of risk for osteoporosis and fragility fractures. The criteria are not always clear and there is no correlation between the criteria used and the type of recommendation made. Of the nine reports that address the issue, one makes a clear negative recommendation (INAHTA), four make positive recommendations with conditions (U.S. Preventive Services Task Force, INSERM, Swedish Council and Catalan Agency) and another four clearly recommend using the procedure (WHO, NIH, European Commission and UK Department of Health).

Based on this information:

1. A study of the recommendations and arguments reveals that attention was focused first on screening patients or clients at risk, followed by perimenopausal or postmenopausal women and, lastly, people who present no known or identifiable risk factors. There is currently a strong interest in using imaging technology to screen for osteoporosis among patients consulting physicians for menopause or other specific health issues.

2. There is a considerably strong consensus against using bone densitometry to screen people who have not been identified as having risk factors, those who consult their physicians for other reasons or both. There is no clear distinction between using bone densitometry for diagnostic or screening purposes and there are no criteria available to make the distinction.

Recommendations on screening people deemed to be "at risk" vary from the unmitigated "yes" to a clear "no", although the majority are in favour. The criteria for targeting these populations vary and include, in no order of priority, risk factors for osteoporosis and risk factors for fragility fractures.

3.4 SYNOPSIS OF THE DISCUSSION ON TREATMENT AND PREVENTION

Pharmacological approaches

The risk of vertebral fractures is reported to have dropped by 30% to 50% among people in the 65+ age group who are taking calcium and vitamin D supplements, postmenopausal women on hormone replacement therapies and osteoporotic patients on bisphosphonates. Two products — alendronate and risedronate, both bisphosphonate derivatives — have been shown to reduce the risk of non-vertebral fractures; risedronate is too recent a development to be mentioned in the reports reviewed. Even more recently, daily injections of the parathyroid hormone has proven effective in reducing non-vertebral fractures among menopausal women who have already sustained a fracture (Neer *et al.*, 2001).

Drug therapy is not without disadvantages. It is expensive and, although effective among known osteoporotics (identified by densitometry or following a fragility fracture), it has significant side effects, prevents fractures only for the duration of the treatment and, lastly, patients have a low rate of compliance with long-term treatment (between 30% and 60%).

In terms of disadvantages, hormone therapy has some redeeming qualities, such as prevention of heart attacks (which has been challenged in recent literature) and the fact that new estrogen preparations have a considerably lower risk of causing cancer. A meta-analysis of trials of hormone replacement therapies shows that, statistically, they are highly effective in reducing non-vertebral fractures among menopausal women, particularly those who started treatment before age 60 (Torgerson *et al.*, 2001).

Non-pharmacological approaches

Compared to pharmacological approaches, there is a dearth of studies on non-pharmacological interventions and, as is the case here, the few studies available are most often mentioned in second place. Several physical activity programs have been shown to help decrease the number of falls and resulting injuries (Stevens *et al.*, 2000). These programs, as well as the methods used to evaluate their effectiveness, are varied. In retirement homes, changes in the surroundings and the introduction of external hip protectors have proven effective on a limited scientific basis. The reports present no convincing data on educational measures even though several reports describe them as important and indicate that they should be included in the clinical practice. Moreover, one report indicates the benefits of combining exercise and vitamin D supplements, thereby tackling both bone density, the risk of falls (increased balance and co-ordination) and quality of life (U.S. NIH). This is speculation based on legitimate, yet theoretical, reasoning.

3.5 SYNOPSIS OF THE DISCUSSION ON DEVELOPMENT OF A SCREENING PROGRAM

There is a real, albeit modest, possibility of preventing fractures through the diagnosis and treatment of osteoporosis. It is estimated that a person who tests positive will require 750 tests to prevent just one fracture over a five-year period of treatment. At best, this approach would help prevent between 1% and 7% of fragility fractures among menopausal women. This low percentage is attributable to the large number of false negatives (two-thirds of patients testing negative will suffer a fracture) and false positives (two-thirds of patients testing positive will not suffer a fracture). Another obstacle is the long waiting period (approximately 25 years) between the intervention at menopause and the expected result (average age for fragility fractures is 75). In spite of this argument, clinicians continue to recommend screening to help patients and physicians make informed decisions on hormone replacement therapy. In light of current clinical practices using hormone replacement therapy, clinicians may feel obligated to offer, and patients to accept, this type of treatment, thereby

creating a sense of inadequacy among those who do not use this method of preventing osteoporosis.

The negative impacts of fractures on mortality, morbidity and quality of life are often cited. In contrast, the high cost of screening and treatment is also mentioned in relation to the fact that they are offered unnecessarily to two-thirds of patients who obtain false positives (they will never suffer a fracture even if they are diagnosed with osteoporosis and left untreated). One report, however, reminds us that hip fractures are, and remain, highly problematic in the population; 80% of women aged 75+ would rather die than sustain a hip fracture (U.S. NIH). Moreover, even if the rate of fractures subsequent to a fall is twice as high among women aged 65+, one report warns that both men and women should be concerned about the problem (European Commission).

Ignorance, fear, avoidance behaviours and depression due to osteoporosis and the risk of fragility fractures have a negative impact on quality of life and hinder preventive lifestyle choices (WHO and U.S. NIH). Self-help groups could play an important role in helping manage osteoporosis and fracture risks within the population (European Commission). Strategies geared exclusively toward the screening and treatment of bone density problems dedicate resources to help a small group of people and, in the process, ignore other preventive approaches that can be applied to a larger segment of the population (European Commission and Catalan Agency).

3.6 SUMMARY OF RECOMMENDATIONS ON PREVENTION AND TREATMENT OF OSTEOPOROSIS AND PREVENTION OF FRAGILITY FRACTURES

As is the case for bone density screening, recommendations for preventing osteoporosis and its consequences are also aimed at specific publics (Table 5). Three of the reports reviewed target populations and health authorities (WHO, UK Department of Health and Catalan Agency), one focuses solely on health authorities (European Commission) and four look exclusively at populations (Canadian Task Force, U.S. Preventive Task Force, INSERM and Swedish Council of Technology Assessment). Three of the reports make no recommendations on the issue of prevention and treatment (INAHTA, BCOHTA, U.S. NIH).

Recommendations for the population focus on the intake of dietary calcium intake, lifestyle choices and drug therapy, and are presented in a theoretical manner (WHO and Swedish Council of Technology Assessment) or in general counselling terms (Canadian Task Force, U.S. Preventive Services Task Force, UK Department of Health and Catalan Agency). The Catalan report stresses the factors linked to falls in the 65+ age group rather than those related to osteoporosis. Two reports, those by WHO and the European Commission, recommend patient education, with the latter agency being the only one to promote support to associations working with people living with osteoporosis. It is important to note that no studies are cited on the effectiveness of these different strategies, since the recommendations are based on expert opinions.

WHO, the European Commission and the UK Department of Health recommend that physicians, health authorities and governments make osteoporosis a major health-care priority. They recommend that physicians receive adequate training and ensure that children and people aged 65+ receive sufficient amounts of vitamin D and calcium. Four of the reports recommend combining efforts in the fight against osteoporosis with those against falls (European Commission, INSERM, UK Department of Health and Catalan Agency).

Table 5: Summary of recommendations on prevention and treatment of osteoporosis and prevention of fragility fractures

Source	Target population	Prevention/ treatment	Recommendation
World Health Organization, 1999 (interim report)	Health authorities – for individuals at risk	Vitamin D and calcium supplements	*Enrich widely*
		Education of health-care professionals and patients	*Support*
		Risk factors	*Raise awareness*
		National programs	*Support*
	Physicians	Malnutrition during growth	*Identify and address*
		Vitamin D supplements for the elderly	*Provide*
		Fall-prevention programs	*Develop*
		Hip protectors for those at high risk	*Consider*
	General population	Physical activity, exposure to sunlight, nutrition with adequate intake of calcium, and healthy body weight	*Maintain*
		Smoking and high alcohol intake	*Avoid*
INAHTA, 1996			No recommendations
European Commission, 1999	Governments	Prevention of osteoporosis: education and training for the public and health-care professionals, tracking of fracture incidence rates	Explicitly identified as a major target for health health care
		Re-allocation of budgets for health-care requirements, provide optimal treatment strategies	Recommended
		Support associations of people with osteoporosis	Financial aid recommended
	Physicians	Adequate training	Should be a priority

Source	Target population	Prevention/ treatment	Recommendation
Canadian Task Force, 1993	Perimenopausal women	Hormone replacement therapy	Counselling recommended
	General female population during periodic health examinations	Identification of risk factors using history and the physical examination	Poor evidence to include or exclude from periodic health examination
BCOHTA, 1997			No recommendations
U.S. Preventive Task Force, 1996	Postmenopausal women	Hormone prophylaxis, smoking, exercise, calcium and vitamin D intake	*Should be counselled and advised*
	People aged 65 and over	Prevention of falls and fall-related injuries	*Should receive counselling*
U.S. NIH, 2001			No recommendation
INSERM, 1996 – 1997	Children	Intake of calcium and vitamin D	Ensure sufficient intake
	Osteoporotic women between the ages of 60 and 75	Treatment for osteoporosis (hormone replacement therapy, bisphosphonates, etc.)	Introduce integrated strategy for prevention and treatment
	Women aged 75 and over	Intake of calcium and vitamin D, screen, treat problems with sight, hearing and balance, limit multiple medications	Increase intake and take steps to reduce fall-related risk factors
UK Department of Health, 1999	Health authorities	Health promotion programs to reduce the prevalence of avoidable risk factors for osteoporosis and falls	*Should recognise that osteoporosis is a significant public health issue*
	People at risk for osteoporosis	Prophylaxis (hormone replacement therapy, calcium, vitamin D, bisphosphonates), advice on smoking and physical activity	*Should have the opportunity to receive*
Swedish Council on Technology Assessment in Health Care, 1997	Young growing individuals	Promotion of physical activity	*Essential to direct preventive efforts*

Source	Target population	Prevention/ treatment	Recommendation
Catalan Agency for Health Technology Assessment, 1999	Governments	Co-ordinate inter-sectorial measures to reduce the risk of falling at home	*Apply inter-sectorial measures*
	Health authorities	Programs to promote healthy lifestyles (modifiable risk factors)	*Preventive measures ... should be encouraged*
		Prepare clinical practice guides	*Would be very valuable to involve clinicians*
	Health-care professionals	Provide patients with information on risks such as a previous fracture and the use of psychotropic drugs	*Should inform the patient*

4. DISCUSSION

We encountered several problems while preparing a synopsis of the reports reviewed. We have detailed below the five most serious difficulties encountered in order to better demonstrate the limitations of this project.

4.1 PUBLICATION BIAS

Since the reports used for this synopsis were compiled from published data, studies that yielded positive results were given more weight than those rarely published trials that yield negative results (Light *et al.*, 1984). Consequently, interventions whose effectiveness is more difficult to prove (often the case with public health measures) are not sufficiently addressed. In the case of osteoporosis, projects aimed at improving nutrition or physical condition fall into this category.

In the same vein, in the case of osteoporosis, there is a disparity between the quantity and quality of publications in favour of drug therapies versus those that advocate non-pharmacological approaches. This is partly due to the fact that drug therapy approaches, which must comply with strict regulations prior to marketing, receive more funding and have greater incentive to publish.

These two reasons could legitimately be used to support the assumption that the reports reviewed underestimate the potential value of public-health interventions. The reports resort more to opinion (or common sense) when discussing them and make less specific recommendations than those made for drug therapies.

The often apparent lack of independence between the scientific evidence submitted and the evaluators of such evidence also contributes to the publication bias. The arguments and recommendations made in most of the reports were taken from articles published by experts involved in the reports. Although this situation seems inevitable, there is no mention of it causing a potential bias in the results.

As there is no direct way of verifying the seriousness of the publication bias and its impact on the recommendations, we urge caution. Strategies that appear weak or are not included in the scientific literature must not be rejected or minimized outright in favour of elements backed by seemingly more solid scientific evidence.

4.2 VARIATIONS IN THE DEFINITION OF THE PROBLEM

Although we only selected reports prepared by governmental and para-governmental agencies for this synopsis, there are vast differences in the definition of the problem and the object under examination. Neither is always clearly formulated, thereby leaving the reader no other alternative but to deduce or speculate in some cases.

There are clearly opposing trends in the definitions of osteoporosis, which range from a natural part of the aging process to a serious illness. These definitions set the tone for the rest of the arguments and recommendations, which also vary from non-medical intervention to comprehensive medical management. The reason for such distinctly different positions becomes apparent when the reader realizes that non-medical intervention applies to the general population, while comprehensive medical management is geared toward patients in a clinical setting. The two procedures have entirely different objectives.

The definition of the object under examination also varies in the reports. They address three subjects either separately or jointly, namely the

prevention of osteoporosis, the treatment of osteoporosis and the prevention of fragility fractures. The objects are relatively easily identified in the reports, even though the distinction between the prevention and treatment of osteoporosis is not always clear. Hormone replacement therapy, for example, seems to be effective in both cases. Oftentimes, elements from one argument are used to complement the advantages of another. One then gets the impression that the treatment objective of hormone therapy, which is of immediate concern to the patient, supplements the objective of prevention, which is a long-term application. It is, however, impossible to combine both effects because the treatment and preventive objectives have different goals and are intended for groups of people defined according to different criteria.

The lack of precision in defining the problem is also reflected in the choice of effectiveness indicators included in the arguments. These indicators, which range from recovery of bone density, to improvements in quality of life, through the prevention of fractures and patient preferences (utility), are never presented side by side; as a result, we do not grasp the relative importance of each. Even though all the reports clearly indicate fracture prevention as the ultimate objective, the discussion often strays from the effectiveness of pharmaceutical preparations in restoring bone mass. The fact that only one of these preparations has demonstrated its effectiveness in reducing the incidence of fractures is rarely mentioned.

The data classification table (Table 1) helped understand the differences in the definitions of osteoporosis and interpret the recommendations in the appropriate perspective.

4.3 DIAGNOSIS OR SCREENING

Regardless of whether it is through bone densitometry or the identification of risk factors, osteoporosis can be defined in two contexts with totally different objectives and target populations. First, diagnosis is geared toward people who have indications or symptoms of osteoporosis. The diagnosis is then confirmed and treatment administered. This could be the case of a menopausal patient, for example, who presents severe lumbar pain and has a history of fragility fractures on her mother's side. The aim of this process is to treat an existing medical condition and to prevent complications.

The second context is screening, which targets people with no symptoms of osteoporosis. They can be divided into two categories. The first group consists of people consulting their physician for a specific health problem that is not, or could be, linked to osteoporosis, and those who ask for or are offered the test. This is the case in particular of women consulting their physician about menopause-related symptoms and who are offered an exploratory densitometry test. This is also the case of patients on corticotherapy and whose bone density is tested periodically. The second group consists of people who are approached in their community to provide a medical history, take the test or both. Unlike the clinical screening administered to patients consulting their physician, the target population in this case has to be defined and strategies developed to reach people where they are, be it at work, at home or elsewhere. For example, for several years, mobile bone densitometry units were deployed in shopping malls across Québec. Whether it clinical or population-related, screening is used to pinpoint a medical condition even before the smallest symptom is detected.

Now, the reports reviewed never make a clear distinction between diagnosis and screening, or clinical screening and population-wide screening. This, however, seems to be a key factor in defining the objective and selecting the criteria to be used to analyze the scientific data. At this stage, it would have been necessary to peruse the texts based on the definitions above in

order to place the various report recommendations in the right context. Tables 4 and 5 have therefore been organized in terms of the target population. In spite of this effort, there is an overlap that is difficult to eliminate. This applies especially to densitometry which, when offered to women at menopause, may be considered either as a screening test or a diagnosis; there is no information available to make the distinction.

4.4 SEMANTIC VAGUENESS

It is remarkable that the reports reviewed contain explicit contradictions, to varying degrees, and frequently use the conditional tense in their recommendations.

There are several instances in the reports where two opposing arguments are used to support conceptually similar ideas. None of the reports presents arguments for and against a recommendation, side by side. The pros and cons overlap constantly, sometimes even in the same sentence. Although opposing points of view are legitimate in a state-of-the-art report, they are often presented here as contradictions that weaken the scientific argument and leave more room for opinions. The abundant use of the conditional tense to formulate recommendations is a sign of the difficulty in reconciling the different points of view. Besides the gaps in the scientific data, the differences may stem partly from the lack of precision in the objective as previously indicated.

4.5 APPLICABILITY OF RECOMMENDATIONS TO QUÉBEC

The 11 reports reviewed cover Europe and North America. None of the recommendations mention differences in application based on the target population. Although there are some references to age and gender, there is no mention of ethnicity, geographic location, climate or environment. With regard to the organization of health services, several of the reports are limited to simple calculations on the increased use of bone densitometry, regardless of distribution of equipment, accessibility or the universality of diagnostic and treatment methods.

Québec's geodemographic situation provides us with further reasons to make the fight against osteoporosis and fragility fractures a province-wide public health priority. Our population is suddenly confronted with four risk factors — white race, low exposure to sunlight (on an annual basis), physical inactivity worsened by confinement during the winter months and the risk of falls resulting from the winter climate and the environment.

It would seem careless to implement recommendations for Québec without taking into account these elements, which are known to influence the prevalence of osteoporosis and the incidence of fragility fractures.

5. A FRAMEWORK FOR PUBLIC HEALTH RECOMMENDATIONS

After breaking down the recommendations in the 11 reports published by different countries, it seems that one of the key components in the fight against osteoporosis and fragility fractures is the identification of "people at risk". There is no doubt that the solution depends primarily on the objective. Starting with the general principle that the goal in preventing and treating osteoporosis is to prevent fragility fractures, it is possible, as indicated in some of the recommendations (European Commission), to design a model for the prevention of fragility fractures that consists of two principal objects — bone fragility and the risk of trauma (caused by a fall, etc.). Factors associated with these two components can, separately or jointly, lead to fractures in people aged 65+ (Figure 3). In this context, osteoporosis defined in terms of low bone mineral density is but one of the factors that determine bone fragility and the risk of fracture.

From the point of view of public health, the identification of risk factors for osteoporosis and for fragility fractures among the population are two elements which, over and above the specific recommendations on population-wide measurement of bone density, remain highly effective (Cadarette *et al.*, 2001). The most common risk factors for trauma and the development of osteoporosis as a precursor to fragility fractures, physical inactivity and a low body mass index become particularly interesting. Two recent Canadian studies (Ontario and Alberta) stress the untapped preventive potential of a previous fragility fracture with only 20% to 50% of patients reporting they received appropriate investigation and adequate treatment for osteoporosis (Hajcsar *et al.*, 2000, Khan *et al.*, 2001).

Difficulties encountered while preparing this synopsis highlight the fragmentation of the areas of expertise in osteoporosis as well as the differences in their objectives. However, there is a considerable amount of information on osteoporosis in the scientific literature, on the Internet and in popular magazines. The recommendations must seek to remedy the lack of consistency between the stakeholders and the information that they are conveying. The recommendations in this report are based on a general objective — the fight against osteoporosis and fragility fractures; a common objective for the professionals and organizations concerned. The recommendations are proposing a framework of defined actions rather than instructions on what must or must not be done — the latter will not last in a field where technology is advancing rapidly.

Recommendations will focus on the following three priority areas:

1. The acquisition of knowledge on the epidemiology and pharmacoepidemiology of osteoporosis in Québec.

2. The development and assessment of strategies to identify risk factors for osteoporosis and fragility fractures among Québecers.

3. Structuring of the interface between clinicians and people at risk for osteoporosis and fractures.

6. CONCLUSIONS

The objective of this study is to summarize reports published worldwide on osteoporosis screening in order to:

- Describe the recommendations and supporting arguments;
- Understand the differences in the recommendations so as to produce a coherent summary;
- Make recommendations for an integrated framework for action against osteoporosis and fragility fractures in Québec.

In light of the differences in the recommendations made by public and para-public organizations, the apparent contradictions in the arguments and the disparity in the scientific information in favour of using imaging technologies and drug therapy for osteoporosis, we have drawn the following four conclusions:

Conclusion 1

It is difficult to summarize the recommendations on osteoporosis screening and the prevention of fragility fractures, as they are indistinguishably based on two models: one favours clinical management and the second, a public-health type prevention approach. As a means of preventing fragility fractures, the two models are not incompatible; however, the reports do not clearly demonstrate their complementarity. This is partly due to the fragmentation of disciplines and the fact that prevention and treatment objectives are not clearly defined.

Conclusion 2

Based on the evidence, none of the 11 reports studied recommends universal bone density screening, i.e., among individuals who present no symptoms of osteoporosis and do not request the test. They also do not recommend bone densitometry for risk-free patients, whether or not they request the test. In spite of these recommendations against intervention, no alternative strategies are put forward for the general public. One aspect that is sometimes alluded to is population-wide screening for risk factors associated with fragility fractures.

Conclusion 3

The reports studied differ on the use of bone densitometry to screen people who present one or more risk factors for osteoporosis or fragility fractures. Although several of the reports agree that the practice could be recommended, they differ on the number and definition of the risk factors. None of the organizations used the prevalence of risk factors among their local populations as a basis for their recommendations. They seem to focus more on the clinicians' need to face the growing demand.

Conclusion 4

All the recommendations describe osteoporosis as a major health-care issue. The research conducted has focused primarily on imaging techniques and pharmacology, rather than integrated strategies to fight osteoporosis and fragility fractures, even though there is no direct evidence that these techniques are efficient. Although it is virtually not addressed in the reports studied, the imbalance — in part caused by the differences in funding capabilities — sometimes reduces the scope of thought on the fight against fragility fractures to the single question of bone densitometry versus hormone replacement therapy.

7. RECOMMENDATIONS

The following recommendations are aimed at initiating a process that will help prevent fragility fractures by fighting against osteoporosis and risk factors associated with osteoporosis and fractures. Although the recommended approaches and interventions largely apply to women, they also extend to the few men who may have several of the risk factors, as well as young people. These recommendations are formulated as objectives to be met.

Recommendation 1

An integrated framework for action should be created to fight osteoporosis and fragility fractures in Québec.

The reports studied for this project clearly demonstrate the need for a framework that integrates and appropriately sets out population-related and clinical interventions. Implementation of this plan will require leadership at the ministerial level and the involvement of many stakeholders from different areas, especially institutions in the health-care and social services network, non-profit organizations that focus on promoting physical activity or healthy eating (for example), seniors' groups and private pharmaceutical or biomedical engineering companies. Although the cost of implementing such a plan has yet to be determined, it would probably be modest compared with the costs incurred by the exponential increase in the availability and use of diagnostic and treatment methods for osteoporosis, which is driven by those having vested interests.

Two objectives arise from the conclusions reached in this report: first, given that universal densitometry screening is not recommended, adequate methods are needed to identify people at risk for fractures. The second objective is to reach a consensus on a guide for good clinical practices for the management of patients consulting a physician and who have one or more risk factors for osteoporosis and fragility fractures. Both objectives are reiterated in the next two recommendations. Their implementation depends on health-care promotion activities, clinical consensus and the co-ordination of epidemiological and evaluative research.

Recommendation 2

Measures should be introduced, and assessed, to raise awareness and to identify Québecers at risk for osteoporosis and fragility fractures.

One objective in this instance would be to encourage people to determine whether they are at risk for osteoporosis and fragility fractures, and to consult their physician. Achieving this objective would help reduce the geographic and social disparities in osteoporosis screening. The methods of action are similar to those used in health-care education and require diversified communications strategies that, in particular, involve using osteoporosis self-help groups. A second objective is to train primary care clinicians to identify those of their patients who present risk factors. This process could be included in periodic health examinations, separate from any discussions on hormone replacement therapy.

There is a need to implement different strategies that will be evaluated in pilot projects. One challenge in this recommendation is to encourage people with risk factors, and who wouldn't otherwise do so, to consult their physicians. The impact of implementing this recommendation can be evaluated by tracking the frequency and distribution of the prescriptions for osteoporosis drugs based on age groups. In the short term, the implementation of the pilot projects will allow for the effects of this measure on the study and control groups to be measured.

Recommendation 3

Guidelines for good clinical practices should be developed, implemented and assessed. They should be updated to take into account new evidence on:

- *The identification of patients seen in primary care at risk for fragility fractures as a result of low bone mass (previous or family history of fragility fractures, low body mass index, estrogen-related problems, etc.);*
- *The identification of people with a high risk for falls and, by extension, for fragility fractures (previous history of falls, social isolation, people on multiple medications, etc.);*
- *Diagnostic indications for bone densitometry and interpretation of results;*
- *Quality control criteria for all aspects of the installation, use and replacement of bone densitometry equipment as technology progresses;*
- *Management of previously identified people, including drug therapy for osteoporosis and referrals to health-care or social services, depending on the type of risks identified.*

The aim of this recommendation is to ensure that people with risk factors for osteoporosis and fragility fractures are given optimal care when they consult their physicians. The primary care physician plays a key role in preventing fragility fractures, regardless of whether they are linked with osteoporosis, the risk of falls or both. Guides to good clinical practices link public health-care actions that help people recognize their risk factors and consult their physicians to the clinical interventions aimed at preventing the fractures. In addition, these guides will help standardize the criteria for measuring and interpreting bone mass results.

Developing the guides is a multidisciplinary task than can only be carried out successfully with strong leadership and the use of an effective methodology to study the evidence and assess the application of the recommendations. The Collège des médecins du Québec [Québec College of Physicians] and related professional association must be involved in this project. The areas of expertise include general medicine, geriatrics, medical specialties interested in osteoporosis, radiology, pharmacy and epidemiology.

The impact of introducing the guides can be measured in terms of the number of physicians reached and by evaluating knowledge of and medical practices related to osteoporosis. Prescriptions for densitometry and osteoporosis drugs in various regions of Québec can also be compared with levels recommended in the guide.

Recommendation 4

Public health interventions should be introduced and assessed with a view to promoting the development of strong bones among adolescents and to preventing falls among people aged 75 and over.

Most of the health-promotion measures already in place are targeted more toward menopausal women or people aged between 60 and 75 and are aimed at increasing physical activity, improving nutrition as well as reducing alcohol intake and smoking. These measures tend to neglect people outside that age group. Consequently, this recommendation has two objectives based on different arguments.

The first objective — ensuring sufficient intake of calcium and vitamin D during growth — is based on theoretical reasoning that is not supported by scientific evidence. However, the reports that deal with this topic unanimously recommend this measure. This objective is not to prevent osteoporosis and fractures later on in life

but rather to promote healthy nutrition among young people, especially those living in economically disadvantaged areas.

The second objective — to develop and assess interventions aimed at reducing the number of falls sustained by people aged 75 and over — is based on proven efficacy, some of which was proven from research projects conducted in Québec. The risk of falls in the 75+ age group depends on an interaction between the physical condition of the individuals and their social as well as their physical environments. The public health and physical rehabilitation sectors could join forces to ensure that preventive measures are developed and evaluated, possibly leading to the establishment of a provincial prevention program.

Recommendation 5

Support for the research required to assess actions against osteoporosis and fragility fractures in Québec should be increased.

For the previous recommendations to be implemented and assessed, osteoporosis and fragility fractures must be given a higher research priority. This increased support for research must especially focus on the development of information tools that will help monitor processes and outcomes related to measures being implemented as a result of these recommendations. The following elements must be given special consideration:

- Measurement of the frequency of osteoporosis, its distribution and risk factors in Québec;

- Inclusion of reliable information on hip and wrist fractures in the 65+ age group in the data obtained from monitoring the status of the population's health;

Ongoing assessment of progress in the use of diagnostic services and drugs for osteoporosis, and completion of comparative analyses for different regions in Québec.

APPENDIX: EXCERPTS FROM CONSENSUS REPORTS ON RECOMMENDATIONS REGARDING OSTEOPOROSIS SCREENING

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

Source: **WHO, 1999, interim report (Genant et al., 1999)**	
Areas covered by the recommendations	
All, but vague on new treatments (such as bisphosphonates).	
Recommendations	**General comments**
The argument for treating or screening all women is poor . . . measurement of density as part of a screening policy involving treatment with HRT is inappropriate . . . There is a good case for screening women in older age groups. An optimal age is 65 years . . . The strategies for screening outlined above are based largely on clinical considerations . . .	Recommendations are focused on developing countries and address three groups: the general population, physicians and health authorities.
For the general population: maintain a physically active lifestyle with adequate exposure to sunlight; avoid smoking and high alcohol intakes; maintain a (recommended) *dietary calcium intake . . . ; maintain a body mass index of not less than 18 kg/m².*	Recommendations to the public: take steps to stay healthy!
For physicians: malnutrition should be considered, identified and addressed during childhood; address (recognize) *hypogonadism, primary hyperparathyroidism, hyperthyroidism and hypercortisolism; make use of bone densitometry when available — intervene when the BMD falls into the osteoporotic range, if not before; provide vitamin D supplementation . . . when appropriate for the climate; develop fall prevention programs for the elderly — consider hip protectors for those at very high risk of falls; minimize glucocorticoid use and consider osteoporosis prophylaxis when these drugs are used.*	The area of prevention is extensive, including malnutrition in children.
For health authorities: facilitate access to bone densitometry for individuals at risk . . . — ensure quality control of the systems; . . . enrich widely used foods with calcium and/or vitamin D if necessary; support the comprehensive education of health professionals . . . in osteoporosis; support patient education . . . raise awareness of risk factors . . . and prevention strategies; support national osteoporosis programs	It is not clear who should have increased access to bone densitometry and the formulation is tainted with opinion.

1. THE DISEASE	
Arguments (WHO, 1999, interim report)	**Comments**
. . . internationally accepted definition describes osteoporosis as a progressive systemic disease . . .	The WHO clearly defines osteoporosis as a disease.
A common disease in developed countries and is likely to become so in developing countries.	
. . . greatly increases the risk of fractures which represent the major relevant clinical aspects of the disease . . . these fractures should not be regarded as an unavoidable price for a longer life . . .	
An estimated 1.7 million hip fractures occurred throughout the world in 1990 . . . that number is expected to exceed 6 million by 2050.	
. . . the lifetime risk (hip fracture) for a Caucasian woman is about 15%. Blacks have about one third the risk and Asians and Hispanics about half the risk of hip fracture.	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

2. SCREENING TEST	
Arguments (WHO, 1999, interim report)	**Comments**
For each standard deviation decrease in bone mineral density, fracture risk approximately doubles. The performance characteristics of BMD to predict fractures are at least as good as the measurement of blood pressure to predict a stroke. *Universal screening of populations by bone densitometry has not been shown to be cost-effective at present, but should be applied to individuals identified by the presence of one or more strong risk factors; it could be argued that menopause is one such risk factor.* *There is considerable lack of uniformity in the presentation of BMD values, in part due to technical differences in equipment, differences in normal ranges, and the complexity of computer outputs.*	There is some contradiction with the recommendation to use bone densitometry testing when it is available.

3. TREATMENT/PREVENTION	
Arguments (WHO, 1999, interim report)	**Comments**
Interventions for which there is consistent, randomized, controlled trial evidence of anti-fracture efficacy include: calcium and vitamin D supplementation in the elderly, hormone replacement therapy in postmenopausal women, and the use of bisphosphonates in established osteoporosis. Calcitonin and selective estrogen receptor modulators (SERMs) may also prevent vertebral fractures. *In general, pharmacological interventions are expensive and can produce adverse effects in certain individuals. They should therefore target those at highest risk of fracture in order to be most cost-effective.* *A cost-effective intervention profile is obtained when bone-active drugs are used at the time of the first fracture or for the treatment of high risk patients, including those with low bone density.*	

4. SCREENING PROGRAM – APPRAISAL	
Arguments (WHO, 1999, interim report)	**Comments**
The cost of treatment for hip fractures is considerable; hospitalization for this fracture represents more than 80% of all costs for osteoporotic fractures. The side effects of drugs, both positive (bone, cardiovascular) and negative (breast/endometrial cancer) need to be included in the cost-effectiveness evaluation. *Facilities for diagnosis and treatment of osteoporosis are inadequate in many countries. This is especially true for the availability of bone densitometry systems.* *Ignorance about osteoporosis is still common among health professionals, patients and the public.*	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

INAHTA, 1996 (Hailey *et al.*, 1996)

Source: **INAHTA, 1996** (Hailey *et al.*, 1996)	
Areas covered by the recommendations	
Bone density measurement, hormone replacement therapy and Calcitonin, with no mention of risk factors (high-risk populations), or preventive and other therapeutic measures.	
Recommendations	**General comments**
The currently available evidence does not support BDM (bone density measurement) *screening of menopausal women in combination with HRT* (hormone replacement therapy) *or SCT(N)* (intranasal salmon Calcitonin) *in the context of population or opportunistic screening for the prevention of fractures, and estimates based on what data are available are not encouraging about its potential effectiveness.*	Conservative document. Presents arguments correctly, although sometimes loosely, without linking them to the resulting conclusions. The greatest weakness is the exclusion of risk factors (high-risk populations), preventive methods and treatments other than hormone replacement and Calcitonin, as well as the side effects (positive and negative) of hormone replacement therapy. Nonetheless, aspects of these topics are used to build the concluding arguments.

1. THE DISEASE	
Arguments (INAHTA, 1996)	**Comments**
Hip fractures are of particular concern because of their high cost in terms of morbidity and mortality, and their economic and social burden. Their number is estimated to increase worldwide from 1.66 million annually in 1990 to over 6 million by the year 2050.	Few factual data on the frequency of the disease and related mortality and morbidity.

2. SCREENING TEST	
Arguments (INAHTA, 1996)	**Comments**
DXA (double energy X-ray absorptiometry) has a reported precision (coefficient of variation for random error) of between 1% and 3% (mostly short-term studies against an in vitro phantom), and a reported accuracy (coefficient of variation for systematic error) of between 2% and 10% (intact bones vs. ashed bones) . . . the accuracy of BDM (bone density measurement) is not high . . . accuracy should be better than 2-4% to identify those at risk of fracture. *There is FAIR evidence that BDM (bone density measurement) can predict the risk of fracture in menopausal women. However . . . BDM cannot reliably distinguish those who will have a fracture from those who will not.* *Even with a precision error as low as 1% SD (standard deviation), serial measurements using BDM would require a minimum follow-up interval of 1 to 1.5 years to detect a bone loss of 2-3% (the average loss per year for a normal woman at menopause) . . .* *A cut-off value of 1 SD yields a sensitivity of 38%, a specificity of 88% and a positive predictive value of 36%.*	Positive argument counterbalanced by a negative argument. No explanation is offered as to which is more important.

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

INAHTA, 1996 (Hailey *et al.*, 1996)

2. SCREENING TEST	
Arguments (INAHTA, 1996)	**Comments**
. . . a 1 SD cut-off below the mean bone mineral density for those without a fracture would result in a 46% detection rate with a 16% false positive rate. (Sensitivity 46%, specificity 84%). *Most available data . . . are likely to underestimate the error which will occur in routine clinical practice.*	

3. TREATMENT/PREVENTION	
Arguments (INAHTA, 1996)	**Comments**
There is GOOD evidence that HRT (hormone replacement therapy) *. . . has a protective effect against bone mass loss . . .* and *. . . that age* (under versus over 60 years old) *does not attenuate the short-term response to treatment.* *There is FAIR evidence that the protective effect of HRT on loss of bone mass . . . wears off after cessation of treatment.* *Data measuring treatment effects in terms of fractures must be interpreted cautiously—some studies use the number of fractures instead of the number of individuals with fractures as the end point, which will overestimate the effectiveness of treatments* (reductions cited: RR from 0.39 to 0.85). *There is FAIR evidence that ever-use of HRT* (hormone replacement therapy) *is associated with a decrease in fractures of all types . . . and no decrease in risk of hip fracture at older ages* (women over 65) (RR cited: 0.45 to 1.03). *There is FAIR evidence that continued long-term use of HTR has a protective effect for fractures* (RR cited: 0.18 to 1.19). *There is FAIR evidence that the longer the period since cessation of therapy* (less or more than 15 years), *the smaller the protective effect of HTR on hip fracture risk* (RR cited: 0.88 to 1.07). *(Poor compliance) . . .* is mainly because of the presence of various side effects (e.g., breast tenderness, bleeding, depression), fear of cancer, dislike of taking tablets and failure to continue treatment when climacteric symptoms disappear. Current data suggest that HRT is associated with a 40-50% reduction in the risk of coronary heart disease among postmenopausal women, and an increased risk of 30-70% for breast cancer, independent of bone mass levels.	Somewhat poor use of statistics in this section. The range of relative risks is broad and the arguments do not provide a clear idea of what that means.

4. SCREENING PROGRAM – APPRAISAL	
Arguments (INAHTA, 1996)	**Comments**
. . . a BMD (bone mass determination) *screening program aimed at menopausal women might prevent between 1% and 7% of fractures.* *Nearly two-thirds of those who will sustain a fracture and who have a BMD will, therefore, have been falsely reassured* (false negatives).	Medical and social relevance brought into question.

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

INAHTA, 1996 (Hailey *et al.*, 1996)

4. SCREENING PROGRAM – APPRAISAL	
Arguments (INAHTA, 1996)	**Comments**
. . . almost two-thirds of women advised to take HRT would be unnecessarily using this treatment . . . (false positive). *Long-term compliance with HRT is likely to be less than 50% for menopausal women* (rates cited: 30% to 59%). *. . . BMD screening of menopausal women linked to subsequent treatment with HRT or SCT(N)* (intranasal salmon Calcitonin) *. . . have not been shown to be beneficial at the ages when most fractures occur* (over 75 years of age). *At what point does a decrease in bone density with age become a medical problem requiring treatment?*	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

INAHTA, 1996 (Hailey *et al.*, 1996)

Source: **European Commission, 1999** (Agnusdei *et al.*, 1999)	
Areas covered by the recommendations	
The entire spectrum of osteoporosis and fragility fractures.	
Recommendations	**General comments**
The European Commission and the governments of the 15 member states, especially policy makers and national politicians, should explicitly adopt osteoporosis prevention as a major health care target and establish awareness campaigns. Prevention of osteporosis should be a major priority in the ongoing health promotion, education and training of health care professionals. *Establish co-ordinated systems for monitoring fracture rates at both national and European Community levels.* *Ensure that national systems are co-ordinated throughout the EU to plan effectively for the resulting increase in demands on health care and to institute appropriate resource reallocation.* *Develop, where appropriate, integrate and implement policies to advise the general public and health professionals about calcium and vitamin D nutrition, at all stages of life.* *Make bone density measurements accessible and reimbursable for high risk individuals.* *Develop and co-ordinate guidelines on criteria for standard treatment strategies. Reimbursement should be available for approved treatments.* *Promote national patient and scientific societies by providing financial support and helping them to publicise their cause throughout the European Community.* *... adequate training of health professionals involved in treating osteoporosis should also be a priority.* *Fund further research (long-term prospective studies) in key areas in order to devise and implement better preventive strategies for osteoporosis.* - *Modifiable determinants of bone mass . . .* - *Identification of risk factors and prevention of falls . . .* - *Better identification of individuals at risk for fracture . . .* - *Assessment of cost/utility of screening of elderly women for osteoporosis* - *Assessment of causes and treatment of osteoporosis in men.*	

Appendix: Extracts from consensus reports on recommendations regarding osteoporosis screening

European Commission, 1999 (Agnusdei *et al.*, 1999)

1. THE DISEASE	
Arguments (European Commission, 1999)	**Comments**
Primary type I osteoporosis (postmenopausal) . . . appears during the 15 to 20 years following menopause and is characterized by predominant bone loss in trabecular bone mass, causing vertebral fractures and fractures of the distal tip of the radius. *Primary type II osteoporosis (senile) is found among elderly individuals of both sexes. It is caused by bone loss affecting both the cancellous and cortical bone, and is associated with vertebral fractures and fractures of the lower end of the femur. In this type of osteoporosis, bone loss is recognized to be largely caused by a lack of vitamin D and by secondary hyperparathyroidism.* *There are many pathogenic factors involved in a large number of osteoporosis cases . . . peak bone mass and, in women, bone loss associated with menopause, significantly determine the risk of fractures in people of all ages.* *They fearly incidence is estimated to rise from 414,000 in 2000 to 972,000 in 2050—an increase of 135% . . . the increase will be greater among men, lowering the present ratio of women to men.* *. . . hip fractures . . . are known to increase exponentially with age, and involve relatively long hospitalization periods (an average of 20 days) and health care costs that follow rising incidence rates. Long-term morbidity associated with hip fractures is extremely high: only a third or less of patients retain their former level of autonomy.* *It is estimated that the number of vertebral fractures will rise from 23.7 million in 2000 to 37.3 million in 2050, representing an increase of 57%.* *. . . an immediate impact of vertebral fractures is to increase suffering in the population . . . only one-third or less of patients who sustain a vertebral fracture complain of a pain that, when present, can be extremely severe; . . .* *. . .* (if, in a simulation), *the incidence of hip fractures and vertebral fractures is practically identical . . . and 10% of patients suffering from vertebral fractures require hospital care, cumulative hospitalization requirements for both types of fractures can be estimated at 110% of the incidence of hip fractures.* *Forearm and hip fractures almost always follow an injury, while vertebral fractures often occur without an obvious injury taking place.*	Good distinction between the different types of fractures, with and without injury, as well as their consequences.

2. SCREENING TEST	
Arguments (European Commission, 1999)	**Comments**
The identification of major risk factors in the patient's clinical profile or medical history is important not only to identify those who should undergo a bone densitometry test, but also because some of the factors could be modifiable and the conditions sometimes curable. *Double energy X-ray absorptiometry is mainly used due to its high reproducibility, the low doses of radiation administered and its ability to measure mineral bone density both in the axial and appendicular portions of the skeleton.* *. . . furthermore, there are differences among the reference values provided by manufacturers . . .*	

Appendix: Extracts from consensus reports on recommendations regarding osteoporosis screening

European Commission, 1999 (Agnusdei *et al.*, 1999)

2. SCREENING TEST	
Arguments (European Commission, 1999)	**Comments**
It should also be noted that current densitometric techniques do not allow a distinction to be made between osteoporosis and osteomalacia . . . *A standard deviation reduction in bone mass (among women in their 70s and 80s) is associated with 1.5 to 2.5 times the risk of fracture. The strength of this correlation is comparable to that between high blood pressure and the risk of a stroke.* *The combination of certain risk factors (previous fractures or recent fractures due to bone fragility and — among elderly patients — factors increasing the likelihood of falls) with mineral bone density values can enhance the ability to predict fractures.* *. . . it must be emphasized that . . . the WHO classification of bone mass provides diagnostic rather than treatment thresholds . . .* *Diagnostic indicators of bone densitometry may be divided into two categories: those used to assess the fracture risk and those used to confirm or rule out a diagnosis of osteoporosis among individuals with vertebral deformities, or with an extensive history of osteoporotic fractures, a radiological osteopenia or diminished body height.* *It is also important to emphasize that bone densitometry may only be justified in cases where the results obtained will have an impact on subsequent treatment decisions.* *Clinical symptoms calling for a bone densitometry test are:* - *Premature menopause (before the age of 45)* - *Prolonged secondary amenorrhea* - *Primary hypogonadism* - *Glucocorticoid therapy* - *Anorexia nervosa* - *Inflammatory bowel disease/malabsorption* - *Primary hyperparathyroidism* - *Organ transplantation* - *Chronic kidney failure* - *Chronic liver disease* - *Hyperthyroidism* - *Prolonged immobilization* - *Maternal history of hip fractures* - *Long-term heparin therapy* - *Radiological proof of osteopenia or vertebral deformity* - *Previous fragility fracture* - *Slight body build* - *Patient is under medical supervision*	

Appendix: Extracts from consensus reports on recommendations regarding osteoporosis screening

European Commission, 1999 (Agnusdei *et al.*, 1999)

3. TREATMENT/PREVENTION	
Arguments (European Commission, 1999)	**Comments**
The main objective of any treatment for osteoporosis is to prevent fractures in patients who have not yet had them, or to prevent aggravating the disease in patients who have already suffered a fracture due to bone fragility.	The recommendations outlined meet the second objective but not the first.
Maintaining a balanced diet is essential for elderly patients, both to prevent fractures and to help them heal faster.	
. . . the incidence of new fractures may be reduced through calcium supplements administered in relatively high does to elderly women who lack calcium and have vertebral fractures.	
. . . those who are especially likely to lack calcium in their diets include the elderly (particularly those living in institutions), postmenopausal women, lactose-intolerant patients, anorexics and individuals following special diets.	
. . . as in the case of calcium, products to be enriched (with vitamin D) must be selected so as to reach high-risk groups.	
Smoking . . . a recent meta-analysis has found that women who smoke are 50% more likely to sustain a hip fracture at some point in their lives . . .	
While only 6% of falls cause fractures and approximately 1% cause hip fractures, the number of fractures resulting from falls is nevertheless considerable in terms of absolute value . . . However, even if it has been shown that factors increasing the likelihood of falls are important independent risk factors for hip fractures among the elderly, there is currently no persuasive evidence showing that actions aimed at reducing the risk of falls lower the risk of hip fractures.	
. . . in a study, Graafmans et al. (1996) established a profile of risk factors linking a history of strokes, dizziness upon standing and postural hypotension, mobility impairment poor mental state. The inclusion of all risk factors in the profile implied an 84% probability of recurrent falls over a period of 28 weeks.	
. . . physical activity among elderly individuals undoubtedly has the greatest impact on osteoporosis by preventing falls and directly affecting bone mineral density.	
There is no RCT (randomized clinical trial) on the effects of estrogen in preventing hip fractures. The results of observation studies indicate that the anti-fracture efficacy of estrogen diminishes or disappears in cases where the treatment is interrupted, suggesting that in order to maintain its beneficial effects, estrogen therapy must be continued indefinitely after menopause.	The recommendations on hormone replacement therapy clearly indicate that it belongs the clinical field rather than the context of preventing fragility fractures.
. . . such a treatment appears not only to be expensive but also unacceptable for many women and inappropriate for men.	
Poor compliance is a recurring problem in estrogen replacement therapies.	
The adverse effects (mastodynia, hemorrhages, deep vein thrombosis, pulmonary embolism and slight increases in the incidence of breast and endometrial cancers—minimized by the simultaneous use of progesterone) must be weighed against the benefits as regards menopausal symptoms, bone loss, ischemic heart disease and perhaps also Alzheimer's disease.	

Appendix: Extracts from consensus reports on recommendations regarding osteoporosis screening

European Commission, 1999 (Agnusdei *et al.*, 1999)

3. TREATMENT/PREVENTION	
Arguments (European Commission, 1999)	**Comments**
. . . (etidronate) is effective in preventing new vertebral fractures among postmenopausal women showing reduced bone mass and several vertebral fractures . . . the cyclical etidronate-based treatment could reduce the risk of fracture among postmenopausal women who are receiving a glucocorticoid treatment. *Strong doses of etidronate can cause osteomalacia.* *. . . (alendronate) has significantly reduced the risk of multiple vertebral fractures, wrist fractures and symptomatic vertebral fractures . . . and has also reduced by 50% the incidence of new hip fractures among women who suffer from osteoporosis and who have an adequate dietary intake of calcium and vitamin D.* *The administration of (alendronate) is contraindicated in patients with a disease of the esophagus.* *Absorption of bisphosphonates is poor . . .* *There is no available information from a CRS (controlled randomized study) on the efficacy of calcitonin in preventing hip fractures . . .* *. . . intranasal calcitonin . . . makes it possible to reduce the incidence of new vertebral fractures among postmenopausal women who have already sustained this type of fracture . . .*	The recommendations on pharmacological treatments clearly situate this type of intervention in a clinical rather than a public health context.

4. SCREENING PROGRAM – APPRAISAL	
Arguments (European Commission, 1999)	**Comments**
(Hormone replacement therapy) does not help to prevent a significant number of fractures before 25 to 30 years of treatment have elapsed. This poses a particular problem at the economic level since net benefits . . . are scaled over a long period, so that their actual worth vis-à-vis *their cost appears negligible.*	
Doctors now have effective pharmacological means to treat women with postmenopausal osteoporosis . . . Clinicians faced with a case of osteoporosis today are much better equipped to treat the condition than they were just a few years ago . . .	Pharmacological treatments are squarely situated in the clinical field without considering patient-visit recommendations.
Teaching osteoporosis patients and their families how to bear the psychological burden of the disease and to take control of their lives is just as important a measure as any medical or other treatment. Support groups offer an ideal framework to discuss ways to manage the disease	Recommendations on support groups are vague as regards targeted patients: those suffering from vs. those at risk of developing osteoporosis.

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

Canadian Task Force on the Periodic Health Examination, 1993 (Feig, 1994)

Source: **Canadian Task Force on the Periodic Health Examination, 1993** (Feig, 1994)	
Areas covered by the recommendations	
Prevention of osteoporotic fractures in women using hormone replacement therapy (HRT).	
Recommendations	**General comments**
It is recommended, therefore, that all women be counselled with regard to the benefits and possible risks of estrogen replacement therapy (B recommendation). *There is poor evidence to include or exclude, in the PHE of asymptomatic women, initial history taking and physical examination to detect risk factors for osteoporotic fractures (C recommendation). No evidence exists for using the physical examination and history taking as screening tools for risk for fractures in postmenopausal women (C recommendation).* *Widespread bone mineral density screening is inadvisable at present (D recommendation).*	Screening is only discussed in the context of using hormone replacement therapy. The recommendation points to a wait-and-see policy as far as scientific evidence is concerned, with no commentary on the social aspects or appraisal of the problem of osteoporosis as described in the introduction.

1. THE DISEASE	
Arguments (Canadian Task Force on the Periodic Health Examination, 1993)	**Comments**
a) Vertebral fractures are the most frequent type of osteoporotic fracture. *b) Vertebral fractures may cause back pain . . .* *c) Progressive vertebral collapse can lead in some cases to . . . chronic pain.* *Hip fractures are associated with more death, morbidity and medical costs than all other osteoporotic fractures combined. The incidence begins to rise after age 50 but rises dramatically after age 70. A 50 year old white woman whose average life-expectancy is 80 years, has a lifetime hip fracture risk of 15% compared with a 5% risk in men. Hip fracture rates are high in American and European whites.* *Mortality rates in the first year following a hip fracture are 12-20% higher than rates in those of similar age and sex who have not sustained a fracture. However, much of the increased mortality may be accounted for by concomitant illness and interventions to prevent hip fracture may not decrease this high mortality. Morbidity following hip fracture is high as well. Of those living at home at the time of fracture who survive the first year, 50% require assistance with walking or with activities of daily living and 15-25% become confined to nursing homes.*	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

Canadian Task Force on the Periodic Health Examination, 1993 (Feig, 1994)

2. SCREENING TEST	
Arguments (Canadian Task Force on the Periodic Health Examination, 1993)	**Comments**
There is no universally accepted level of osteopenia or fracture risk at which it is agreed treatment should be initiated. *To date no randomized controlled trials have screened asymptomatic women and demonstrated the efficacy of screening in decreasing fracture rates..*	

3. TREATMENT/PREVENTION	
Arguments (Canadian Task Force on the Periodic Health Examination, 1993)	**Comments**
There is fair evidence from case-control, cohorts and one randomised controlled study to suggest that ERT prevents osteoporotic fractures, including, most importantly, fractures of the hip. Current users and those starting estrogen therapy within 3-5 years of the menopause seem to benefit most. *There is little information regarding when to discontinue therapy, if at all.* *The benefit of starting ERT in older women (for example, over 70 years) is unknown since most studies have been based on younger women.* *The increased risk of endometrial cancer due to unopposed estrogen has been demonstrated in both case-control and cohort designs . . . This risk appears to be eliminated by the addition of progesterone.* *There is fair evidence to suggest that there is no increased risk of breast cancer when estrogens are taken for a short period (5 years or less). However, ERT may lead to a small increased risk in breast cancer, if taken for more than 10 years.* *In summary, there is fair evidence to suggest that ERT leads to a decreased rate of cardiovascular (CV) mortality. . . There is reason to believe that the addition of progesterone may lower the HDL and thereby negate the beneficial effects seen on CV mortality.*	

4. SCREENING PROGRAM – APPRAISAL	
Arguments (Canadian Task Force on the Periodic Health Examination, 1993)	**Comments**
Complex models for risk factor assessment (fractures and decreased bone density) have poor sensitivity and specificity as screening procedures.	

Appendix: Extracts from consensus reports on recommendations regarding osteoporosis screening

B.C. Health Technology Assessment, 1997 (Green, 1997)

Source: **B.C. Health Technology Assessment, 1997** (Green, 1997)	
Areas covered by the recommendations	
Focuses on population and public health. Vaguer on the specifics of treatment and prevention pharmacology.	
Recommendations	**General comments**
Although hip fractures clearly have serious . . . implications . . . the results of a BMD test, as measured by any of the currently available technologies, including ultrasound, is an unsuitable measure upon which to base clinical decisions. *. . . does knowledge of BMD accurately identify women who will have fractures later in life and does knowledge of risk status ultimately change the clinical course of fragility fractures? The answer to these two questions is "no."*	Recommendations are "dehumanized" since, if nothing is seen to be suitable, what does one say to people who might have the disease, or to public organizations that cannot simply ignore the problem? Providing the recommendations in a question-and-answer format is too restrictive to satisfy all parties who have a stake in this issue. To a certain extent, this criticism is similar to that made by the authors on how attention is diverted away from what is truly important.

1. THE DISEASE	
Arguments (B.C. Health Technology Assessment, 1997)	**Comments**
This (the present) *analysis challenges the assumption that menopause is a disease, and calls into question the usefulness of both BMD testing and HT for all women approaching age 50.* *Mortality rates in the first year following a hip fracture are 12% to 20% higher than rates in those of a similar age and sex who have not sustained a fracture.* *. . . 85% of women aged 50 with a life expectancy of 80 years will not suffer a hip fracture.* *From 1990 through 1995, 1,127 residents of Vancouver were admitted . . . with a diagnosis of hip fracture.*	

2. SCREENING TEST	
Arguments (B.C. Health Technology Assessment, 1997)	**Comments**
BMD (bone mass determination) *measurements are poor predictors of . . . fractures.* (Figures cited: *sensitivity 30-50%, specificity 80-85%, positive predictive value 50%*). *. . . regardless of the threshold chosen, most women who will suffer a hip fracture . . .will be classified as normal . . .* *. . . research has not linked BMD testing to changes in physicians' prescribing patterns.*	

Appendix: Extracts from consensus reports on recommendations regarding osteoporosis screening

B.C. Health Technology Assessment, 1997 (Green, 1997)

2. SCREENING TEST	
Arguments (B.C. Health Technology Assessment, 1997)	**Comments**
BMD testing and reporting increased from approximately 2,000 tests in 1989/90 to 18,679 in 1995/96. *Strong public policy efforts supported by objective analyses are therefore needed to support clinicians and health care institutions resisting adoption of widespread BMD testing of well women.*	The arguments seem to contradict one another.

3. TREATMENT/PREVENTION	
Arguments (B.C. Health Technology Assessment, 1997)	**Comments**
Clinical management decisions should not be altered by BMD test results . . . (in asymptomatic women) (including hormone therapy and risk assessment).	

4. SCREENING PROGRAM – APPRAISAL	
Arguments (B.C. Health Technology Assessment, 1997)	**Comments**
. . . alteration of (BMD) *may or may not lead to fracture reduction. Even with optimistic assumptions the percentage of fractures prevented would be . . . between 0.34 to 6.7%.* *Using the most optimistic estimates for each of the individual components, the magnitude of the anticipated impact of a BMD screening program* (fewer fractures) *is still relatively modest* (0.34% to 18%). Cummings *et al.* 1995 figure reproduced showing an added value of BMD testing in women with 5 or more risk factors in predicting hip fractures: . . . *women with the lowest third of calcaneal bone density had twice the rate of hip fracture as the middle third and three times that of the highest third.* *The known associations between characteristics* (elicited from a history and clinical exam) *and fractures do not identify a sub-population at high risk.* *Strategies which measure and treat low BMD alone, while ignoring other prominent risk factors, will likely divert limited health care funds from a more effective and efficient approach.* *According to at least one study, women who are advised they have "low" bone mineral density may inappropriately restrict their activity levels . . .* *False negatives are individuals who may be inappropriately reassured that they are not at risk and may fail to undertake needed preventive measures although they will sustain future fractures.*	The arguments seem to contradict one another.
The greatest concern is that BMD measurement will misdirect treatment efforts away from the majority of women who will ultimately suffer fractures, by focusing attention on the minority with low bone density.	The arguments seem to contradict one another.

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

U.S. Preventive Services Task Force, 1996 (Wallace *et al.*, 1996)

Source: **U.S. Preventive Services Task Force, 1996** (Wallace *et al.*, 1996)	
Areas covered by the recommendations	
All areas. Strong focus on economic analysis.	
Recommendations	**General comments**
There is insufficient evidence to recommend for or against routine screening for osteoporosis with bone densitometry in postmenopausal women.	Lukewarm recommendations that leave the door wide open to user clinicians.
Recommendations against routine screening may be made on other grounds.	
All postmenopausal women should be counselled about hormone prophylaxis and be advised of the importance of smoking cessation, regular (weight-bearing) exercise, and adequate calcium (and vitamin D) intake.	Recommendations for a healthy lifestyle—without offering specific measures.
Elderly persons should also receive counselling regarding preventive measures to reduce the risk of falls and the severity of fall-related injuries.	
For those high-risk women who would consider estrogen prophylaxis only to prevent osteoporosis (only if they knew they were at high risk for osteoporosis or fracture), screening may be appropriate to assist treatment decisions.	Ambiguous recommendation targeting high-risk women (indeed especially their physicians). Different wording in two places.

1. THE DISEASE	
Arguments (U.S. Preventive Services Task Force, 1996)	**Comments**
An estimated 1.3 million osteoporosis-related fractures occur each year in the U.S. About 70% of fractures in persons aged 45 or older are types that are related to osteoporosis.	In general the language is vague (repeated use of "may").
Over half of all postmenopausal women will develop a spontaneous fracture as a result of osteoporosis . . . there is a 15-20% reduction in expected survival in the first year following a hip fracture. By one estimate, a 50-year-old woman in the 10th percentile of bone density has a 25% lifetime risk of hip fracture (vs. 8% for those in the 90th percentile).	
Among persons living at home at the time of a hip fracture, about half experience a deterioration in social function within 2.5 years.	
The annual cost of osteoporosis-related fractures in the U.S. has been estimated to be over $8 billion in direct and indirect costs.	
There is little evidence from controlled trials that women who receive bone density screening have better outcomes (improved bone density or fewer fractures) than women who are not screened.	
Prospective cohort studies have demonstrated the dose-response relationship between BMD (bone mineral density) *and fracture risk.*	
Because the rate of postmenopausal bone loss varies among women, bone mass at menopause correlates only moderately with bone mass 10 to 20 years later, when most fractures occur.	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

U.S. Preventive Services Task Force, 1996 (Wallace *et al.*, 1996)

2. SCREENING TEST	
Arguments (U.S. Preventive Services Task Force, 1996)	**Comments**
DXA (dual energy x-ray absorptiometry) *is now widely used . . . with shorter examination times (5 to 10 minutes) . . .*	
Most experts agree that DXA is a safe, accurate, and precise (about 0.5-2% variation on repeated measurement) modality for measuring bone density that may be useful in the clinical setting.	
Reproducibility of SPA (single photon absorptiometry) *is similar to . . . DXA, but the cost per scan is significantly lower . . . Evidence suggests that SPA of the radius or calcaneus is also predictive for future risk of non-spine fracture.*	
Ultrasound technology for assessing bone density and architecture is under development and may be of value in the future.	
. . . there is no value of BMD that discriminates well between patients who develop a fracture and those who do not. Other risk factors that independently influence falls or bone strength may be more important than low BMD for identifying older women at high risk of fracture.	This argument contradicts the two that follow it.
. . . measurement of bone density may be useful for identifying persons at high risk of fracture who might not otherwise consider effective treatments such as estrogen.	
Measures of bone density provide more reliable estimates of risk than clinical assessment . . .	

3. TREATMENT/PREVENTION	
Arguments (U.S. Preventive Services Task Force, 1996)	**Comments**
In a randomized trial in healthy postmenopausal women, calcium supplementation slowed bone loss and significantly reduced symptomatic fractures over 4 years.	
Numerous observational and non-randomized experimental studies suggest that risk of fracture can be reduced 25-50% by estrogen replacement therapy . . . preventing fractures in older postmenopausal women may require continuing hormone therapy indefinitely.	
If other more specific and expensive therapeutic modalities (e.g., bisphosphonates, Calcitonin) are shown to be effective in reducing fractures in asymptomatic high-risk women, however, this may increase the role of screening to identify appropriate candidates for treatment.	This comment is obscure and appears to contradict other arguments.
Hygienic measures such as adequate calcium and vitamin D intake, exercise, and smoking cessation can be recommended irrespective of bone density. The decision to begin estrogen, in contrast, often depends on factors other than risk of osteoporosis.	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

U.S. Preventive Services Task Force, 1996 (Wallace *et al.*, 1996)

4. SCREENING PROGRAM – APPRAISAL	
Arguments (U.S. Preventive Services Task Force, 1996)	**Comments**
There is limited evidence that screening influences treatment decisions, and that women appreciate the more precise estimates of risk provided by BMD measurement.	
Screening could have adverse effects, if it leads to "labelling" in patients diagnosed with osteopenia or osteoporosis, or false reassurance in those with normal bone density. In one study of women referred for screening, women with low bone density were more likely to restrict their activities, and those with normal bone density were less likely to follow routine hygienic measures to prevent osteoporosis (e.g., calcium or vitamin D).	This argument contradicts the following one.
Measures of bone density . . . may help both the patient and the clinician make more informed decisions about the potential benefits and risks of therapies such as estrogen.	
Average costs of screening have been estimated to be $75 with SPA, $75-100 with DXA, $100-150 with DPA, and $100-200 with QCT . . . further research is necessary to demonstrate both the clinical effectiveness and cost-effectiveness of different screening and treatment strategies.	
There is little reason for screening if the information is not likely to influence decisions by the patient or provider. For most women, osteoporosis prevention is only one of many factors that go into the decision whether or not to take estrogen.	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

USA National Institutes of Health, 2000 (NIH, 2001)

Source: **U.S. National Institutes of Health, 2000** (NIH, 2001)	
Areas covered by the recommendations	
The NIH conference does not aim to make recommendations but to discuss new findings on osteoporosis and ways to prevent, diagnose and treat the disease.	
Recommendations	**General comments**
. . . there is general consensus that bone density measurement should be considered in patients on glucocorticoid therapy for 2 months or more and patients with other conditions that place them at high risk for osteoporotic fracture. *Adults with vertebral, hip, or distal forearm fractures should be evaluated for osteoporosis and, if indicated, therapy.* *The value of universal screening, especially in perimenopausal women, has not been established.* *. . . an individualized approach is recommended. A bone density measurement should be considered when it will help the patient decide whether to institute treatment to prevent osteoporotic fracture.*	While no official recommendations are provided, fairly clear guidelines may be extracted from the document.

1. THE DISEASE	
Arguments (U.S. National Institutes of Health, 2000)	**Comments**
Osteoporosis is defined as a skeletal disorder characterized by compromised bone strength predisposing to an increased risk of fracture. Bone strength reflects the integration of two main features: bone density and bone quality. *A fracture occurs when a failure-inducing force is applied to osteoporotic bone. Thus, osteoporosis is a significant risk factor for fracture, and a distinction between risk factors that affect bone metabolism and risk factors for fracture must be made.* *It is important to acknowledge a common misperception that osteoporosis is always the result of bone loss . . . sub-optimal bone growth in childhood and adolescence is as important as bone loss to the development of osteoporosis.* *Osteoporosis can be further characterized as either primary or secondary. Primary osteoporosis can occur in both genders at all ages but often follows menopause in women and occurs later in life in men. In contrast, secondary osteoporosis is a result of medications, other conditions or diseases.* *Optimization of bone health is a process that must occur throughout the life span in both males and females. Factors that influence bone health at all ages are essential to prevent osteoporosis and its devastating consequences.* *Genetic factors exert a strong and perhaps predominant influence on peak bone mass, but physiological, environmental, and modifiable lifestyle factors can also play a significant role. Among these are adequate nutrition and body weight, exposure to sex hormones at puberty, and physical activity.*	This is one of the most critical and interesting definitions of the problem. The disease is situated in the wider context of bone capital, and the correlated problem of fractures.

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

USA National Institutes of Health, 2000 (NIH, 2001)

1. THE DISEASE	
Arguments (U.S. National Institutes of Health, 2000)	**Comments**
Childhood is also a critical time for the development of lifestyle habits conducive to maintaining good bone health throughout life. Cigarette smoking, which usually starts in childhood, may have a deleterious effect on achieving bone mass. *Reduction in estrogen production with menopause is the major cause of loss of BMD during later life. Timing of menarche, absent or infrequent menstrual cycles, and the timing of menopause influence both the attainment of peak bone mass and the preservation of MMD.* *White postmenopausal women experience almost three-quarters of hip fractures and have the highest age-adjusted fracture incidence.* *Fracture risk has been consistently associated with a history of falls, low physical function, . . . impaired cognition, impaired vision and the presence of environmental hazards.* *Nursing home residents are at particularly high risk of fracture because most have low BMD and a high prevalence of other risk factors for fracture, including advanced age, poor physical function, decreased cognition and high rates of dementia, poor nutrition and, often, multiple medications.*	

2. SCREENING TEST	
Arguments (U.S. National Institutes of Health, 2000)	**Comments**
Bone mineral density (BMD) is frequently used as a proxy measure and accounts for approximately 70% of bone strength. The World Health Organization (WHO) operationally defines osteoporosis as bone density 2.5 standard deviations below the mean for young white adult women. It is not clear how to apply this diagnostic criterion to men and children, and across ethnic groups. *Because of the difficulty in accurate measurement and standardization between instruments and sites, controversy exists among experts regarding the continued use of this diagnostic criterion.* *Predictors of low bone mass include female gender, increased age, estrogen deficiency, white race, low weight and body mass index (BMI), family history of osteoporosis, smoking and history of prior fracture . . . Late menarche, early menopause, and low endogenous estrogen levels are also associated with low BMD in several studies.* *. . . some measures of physical function and activity have been associated with increased bone mass.* *The goals for the evaluation of patients at risk for osteoporosis are to establish the diagnosis of osteoporosis on the basis of assessment of bone mass, to establish the fracture risk, or to make decisions regarding the needs for instituting therapy. A history and physical examination are essential in evaluating fracture risks.* *Recent prospective studies using quantitative ultrasound (QUS) of the heel have predicted hip fracture and all non-vertebral fractures nearly as well as DXA at the femoral neck. QUS and DXA (dual energy X-ray absorptiometry) at the femoral neck provide independent information about fracture risk, and both of these tests predict hip fracture risk better than DXA at the lumbar spine . . . there is uncertainty over whether the results of these trials can be generalized to patients identified by QUS to have high risk of fracture.*	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

USA National Institutes of Health, 2000 (NIH, 2001)

2. SCREENING TEST	
Arguments (U.S. National Institutes of Health, 2000)	**Comments**
It has been suggested that the diagnosis and treatment of osteoporosis should depend on risk-based assessment rather than solely on the assessment of a T-score. *Bone remodelling can be assessed by the measurement of surrogate markers of bone turnover in the blood or urine . . . However, marker levels do not predict bone mass or fracture risk and are only weakly associated with changes in bone mass. Therefore, they are of limited utility in the clinical evaluation of individual patients.*	

3. TREATMENT/PREVENTION	
Arguments (U.S. National Institutes of Health, 2000)	**Comments**
Sufficient data exist to recommend specific dietary calcium intakes at various stages of life . . . Vitamin D is required for optimal calcium absorption and thus is also important for bone health. *There is strong evidence that physical activity early in life contributes to higher peak bone mass . . . Exercise during the later years, in the presence of adequate calcium and vitamin D intake, probably has a modest effect on slowing the decline in BMD . . . There is convincing evidence that exercise in elderly persons also improves function and delays loss of independence and thus contributes to quality of life. Randomized clinical trials of exercise have been shown to reduce the risk of falls by approximately 25%, but there is no experimental evidence that exercise affects fracture rates.* *. . . many women would need to be treated in order to prevent a single fracture. For example, in white women aged 50-59, 750 BMD tests would be required to prevent just one hip or vertebral fracture over a 5-year period of treatment.* *. . . the value has not been established for the common practice of beginning preventive drug therapy in the perimenopausal period for the purpose of preventing fractures later in life.* *Randomized clinical trials have demonstrated that adequate calcium intake from diet or supplements increase spine BMD and reduce vertebral and non-vertebral fractures.* *Trials (of exercise intervention) in older adults have successfully used various forms of exercises to reduce falls.* *Cyclic etidronate, alendronate and risedronate consistently reduce the risk of vertebral fractures by 30 to 50%.* *Alendronate and risedronate reduce the risk of subsequent non-vertebral fractures in women with osteoporosis and adults with glucocorticoid-induced osteoporosis.* *HRT (Hormone Replacement Therapy) trials have shown decreased risk of vertebral fractures. There have been no trials of estrogen with hip fracture as the primary outcome. Observational studies have indicated a significant hip fracture reduction in cohorts of women who maintain HRT therapy. There have been no trials of estrogen with hip fracture as the primary outcome.* *Raloxifene, a SERM (selective estrogen receptor modulator) approved by the FDA for the treatment and prevention of osteoporosis, has been shown to reduce the risks of vertebral fracture by 36% in large clinical trials.*	

USA National Institutes of Health, 2000 (NIH, 2001)

3. TREATMENT/PREVENTION	
Arguments (U.S. National Institutes of Health, 2000)	**Comments**
Non-pharmacological interventions directed at preventing falls and reducing their impact have been promising. These include studies to improve strength and balance in the elderly, as well as using hip protectors to absorb or deflect the impact of a fall.	

4. SCREENING PROGRAM – APPRAISAL	
Arguments (U.S. National Institutes of Health, 2000)	**Comments**
The consequences of osteoporosis include the financial, physical and psychosocial, which significantly impact the individual as well as the family and community. An osteoporotic fracture is a tragic outcome of a traumatic event in the presence of compromised bone strength, and its incidence is increased by various other risk factors. *Hip fracture has a profound impact on quality of life, as evidenced by findings that 80% of women older than 75 years preferred death to a bad hip fracture resulting in nursing home placement. However, little data exist on the relationship between fractures and psychological and social well-being. Fear, anxiety and depression are frequently reported in women with established osteoporosis and are likely underaddressed when considering the overall impact of this condition.*	The document accurately defines the problem in terms of solutions that should be complementary, but that might seem to conflict with one another in their application. This is particularly evident in their discussion of the diagnosis of osteoporosis, which is one of the elements and whose importance satisfies many criteria: predictive value, potential to act on a given factor and inability act on all the other factors.

Appendix: Extracts from consensus reports on recommendations regarding osteoporosis screening

INSERM, 1996 (Alexandre *et al.*, 1996)

Source: **INSERM, 1996** (Alexandre *et al.*, 1996)	
Areas covered by the recommendations	
All areas covered. Particular emphasis on the epidemiological aspects of the screening test.	
Recommendations	**General comments**
In the first years of life: ensure a sufficient dietary intake of calcium and vitamin D. *Research: explore the mechanisms involved in genetic determination of bone mass.* *At menopause: actively take into account the potential consequences of estrogen deficiency.* *Systematic osteoporosis screening at menopause does not currently appear to be useful . . .* *Research: Evaluate women's compliance with preventive osteoporosis treatments at menopause.* *Look for new bone resorption inhibitors.* *Explore the factors involved in bone formation.* *From the age of 60: carry out a widespread, integrated screening, prevention and treatment strategy.* *Women aged 60 to 75 can be divided into three groups:* • *Postmenopausal women who sustain any type of fracture following a minor fall should, until proven otherwise, be considered osteoporotic.* • *(For) women with a family history of fractures . . . and who are following a treatment that is likely to contribute to bone loss (e.g., corticoids . . .) . . . bone density measurement could be helpful in deciding on an eventual course of treatment.* • *(For) women showing no apparent or identifiable risk factor . . . an osteoporosis screening could be considered in order to prescribe a fracture-preventing treatment to those showing reduced bone density (HRT, bisphosphonates . . .).* *Research: Study the feasibility of osteoporosis screening for women.* *Evaluate and compare the long-term effects of different medication and supplementation strategies.* *For the elderly: increase calcium and vitamin D intake and address fall-related risk factors.* • *. . . it is reasonable to recommend calcium and vitamin D supplements to elderly individuals who are living in institutions or who are housebound.* • *For elderly people retaining a certain amount of autonomy, this supplementation could be part of a set of recommendations aimed at improving their often insufficient or unbalanced diets.* • *Among the very aged, prevention cannot only be geared toward maintaining bone mass. Actions aimed at identifying and correcting problems with sight, hearing and balance, and at limiting multidrug therapy should be implemented in order to prevent falls and also to improve patients' quality of life.*	Interesting recommendations because they set different priorities according to different age groups — an approach that corresponds to knowledge on the epidemiology of osteoporosis and fractures. The document adopts an overarching approach to osteoporosis rather than simply focusing on screening.

Appendix: Extracts from consensus reports on recommendations regarding osteoporosis screening

INSERM, 1996 (Alexandre *et al.*, 1996)

1. THE DISEASE	
Arguments (INSERM, 1996)	**Comments**
Osteoporosis is a true public health problem. Its incidence is on the rise: in France, the annual number of fractures of the upper femur is currently estimated at 50,000. This number will probably double by 2050. *Twenty-five percent of women between the ages of 60 and 75 are already osteoporotic and an additional 25% will become osteoporotic before the age of 80.* *. . . 75% of patients over the age of 65 who have suffered a femoral fracture are women.* *Osteoporotic fractures are often the cause of major changes in people's living conditions and habits, resulting in increased dependence and even the risk of death . . . Estimated direct medical costs created by osteoporotic fractures have only been very partial to date.* *Beyond the age of 75 to 80, the risk of falls and fractures . . . becomes a major problem. Actions as diverse as modifying the living environment, correcting perceptual difficulties, and recommending physical exercise or padded protective clothing are effective but often difficult to implement.* *Osteoporosis is a pathology of multiple origins closely tied to the life cycle of the skeleton, which is characterized by a period of bone mass accumulation followed by a period of bone mass stabilization. At menopause, a gradual loss of bone mass commences..*	

2. SCREENING TEST	
Arguments (INSERM, 1996)	**Comments**
Double energy X-ray absorptiometry (DXA) is currently the most reproducible technique to measure bone mass . . . heel ultrasounds appear to have a similar predictive value to X-ray absorptiometry, and they probably cost less and are easier to carry out . . . measuring biochemical urinary markers (pyridinoline and its derivatives) seems to be an effective screening method in conjunction with physical procedures.	

3. TREATMENT/PREVENTION	
Arguments (INSERM, 1996)	**Comments**
Hormone Replacement Therapy (HRT), consisting of estrogen and progesterone, is currently the only available preventive treatment for osteoporosis. *The optimal duration of HRT has not been precisely established, but a period of at least seven to 10 years appears to be necessary to prevent osteoporosis in the long term.* *Although HRT does not increase the risk of breast cancer in the short term, it might slightly increase the risk after 10 years of treatment (relative risk varies between 1.06 and 1.3, depending on the study). Today the risk of endometrial cancer is negligible, due to the current practice of combining progesterone with estrogen.* *New osteoporosis treatments are under evaluation. Bisphosphonates . . . "anti-estrogen" (partial estrogen agonists). It is . . . still too early to identify other types of risk associated with using these substances.*	

Appendix: Extracts from consensus reports on recommendations regarding osteoporosis screening

INSERM, 1996 (Alexandre *et al.*, 1996)

4. SCREENING PROGRAM – APPRAISAL	
Arguments (INSERM, 1996)	**Comments**
Systematic screening for osteoporosis at menopause currently does not appear to be useful, given the low prevalence of the disease at that age (5%) and the possibility of prescribing an HRT to treat symptoms specifically related to menopause. (In France, 30% of women between the ages of 50 and 60 receive hormone replacement therapy.) *The prevalence of osteoporosis among women aged 60 to 75 is high (an estimated 25%). The vast majority of these women are not receiving and have never received an osteoporosis prophylaxis. They . . . would be an appropriate target for a strategy to prevent osteoporotic fractures.*	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

U.K. Department of Health and the Royal College of Physicians, 1999 (U.K. Department of Health, 1999)

Source : **U.K. Department of Health and the Royal College of Physicians, 1999** (U.K. Department of Health, 1999)	
Areas covered by the recommendations	
The scope of the guidelines is to review the assessment and diagnosis of osteoporosis, the therapeutic agents available and the manner in which these can be used to develop management strategies for both the prevention and the treatment of osteoporosis, with the aim of reducing fracture rates.	
Recommendations	**General comments**
The working group recommends the use of these tests (to measure bone mineral density) in the context of a case-finding strategy . . . where patients are identified because of a fragility fracture or by the presence of strong risk factors . . . rather than for population screening. Such patients include: radiographic evidence of osteopenia and/or vertebral deformity; loss of height, thoracic kyphosis; previous fragility fracture; prolonged corticosteroid therapy; premature menopause (less than 45); prolonged secondary amenorrhea (over one year); primary hypogonadism; chronic disorders associated with osteoporosis; maternal history of hip fracture; low body mass index < 19 kg/m^2. *The working group does not recommend the use of other techniques, including quantitative ultrasound and computed tomography for the diagnosis of osteoporosis. This does not preclude the use of these or other validated techniques in risk assessment.* *The working group makes no recommendations concerning such population-based strategies (physical activity, smoking and dietary calcium intake).* *It is recommended (grade C) that the risks and benefits of HRT be explained to women at the time of the menopause or later, so that an informed decision can be made concerning its use.* *Recommendations for training (physicians)* *It is recommended that guidelines be locally developed for the identification of patients at high risk and that general practitioners follow the recommendations for referral.* *Recommendations for health authorities* *We recommend that health authorities . . . recognise that osteoporosis is a significant public health issue, and ensure that it is dealt with explicitly in their local health improvement programme.* *They should ensure that the local health improvement programme addresses approaches to reducing the prevalence of avoidable risk factors for osteoporosis and fracture-inducing falls and, in so doing, make explicit the roles of both the NHS and other agencies.* *They should put arrangements in place so that those at particularly high risk of osteoporosis have the opportunity to receive appropriate investigation (e.g., bone density measurement), prophylaxis (e.g., HRT, or calcium and vitamin D, or calcium and bisphosphonates) and advice (e.g., about smoking and physical activity).* *They should purchase bone density measurements by means of dual X-ray absorptiometry for the particular clinical indications* (case finding, see above). *They should NOT institute mass population screening of bone density in postmenopausal women.* *Recommendations to the Department of Health* *As these guidelines will be adapted for local use, we* ***recommend*** *that criteria for monitoring compliance be developed.* *We* ***recommend*** *that these guidelines be subjected to review in 5 years time . . .*	We have included only relevant recommendations for screening and prevention and not for treatment. The distinction made here between diagnosis and risk assessment is not clear. The Royal College of Physicians adopts a passive stance by recommending that patients be referred to specialists rather than be cared for by general practitioners. Recommendations for prevention are addressed to local authorities (fall prevention) while those for technology use are addressed to users. This does not promote an integrated approach. In fact, the message to public health authorities is somewhat vague. However, their is a clear encouragement to purchase technology, resulting in a somewhat contradictory position.

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

U.K. Department of Health and the Royal College of Physicians, 1999 (U.K. Department of Health, 1999)

1. THE DISEASE	
Arguments (U.K. Department of Health and the Royal College of Physicians, 1999)	**Comments**
Osteoporosis is defined as a "progressive systemic skeletal disease characterised by low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture" (World Health Organization 1994). *Osteoporosis denotes a value for BMD, or bone mineral content, that is 2.5 standard deviations (SDs) or more below the young adult mean value . . . a similar cut-off for BMD . . . can be taken for . . . men.* *More than one-third of adult women will sustain one or more osteoporotic fractures in their life-time. Lifetime risk in men is . . approximately half that in women.* *In the UK, osteoporosis results in over 200,000 fractures each year, causing severe pain and disability to individual sufferers at an annual cost to the National Health Service (NHS) of over £940 million.* *Hip fractures alone account for more than 20% of orthopaedic bed occupancy in the UK, and the majority of the direct health service costs of osteoporosis.* *The ageing of the UK population will give rise to a doubling of the number of osteoporotic fractures over the next 50 years if changes are not made in present practice.*	Adoption of the WHO definition of osteoporosis.

2. SCREENING TEST	
Arguments (U.K. Department of Health and the Royal College of Physicians, 1999)	**Comments**
Systematic review of observational studies with the use of absorptiometric techniques indicates that the risk of fracture increases approximately twofold for each standard deviation decrease in BMD (bone mineral density). *The predictive value of BMD for fracture is at least as good as that of blood pressure for stroke.* *. . . DXA* (dual-energy X-ray absorptiometry) *at the hip is the preferred site, particularly in elderly individuals, because of its higher predictive value for fracture risk.* *The use of BMD alone to assess risk* (of fracture) *has a high specificity but low sensitivity (approximately 50%).*	

3. TREATMENT/PREVENTION	
Arguments (U.K. Department of Health and the Royal College of Physicians, 1999)	**Comments**
Approaches to decreasing fracture risk for the population include increasing the level of physical activity undertaken at all ages, reducing the prevalence of smoking, and increasing dietary calcium intake . . . there is some evidence that bone mass can be modulated by calcium or changes in other lifestyle habits before the attainment of skeletal maturity. *In women at the time of ovarian failure, hormone replacement therapy (HRT) is a logical and appropriate first-line intervention to consider for the prevention of osteoporosis . . . Potential benefits include a decrease in cardiovascular morbidity and mortality (level III). There may also be a small increase in the risk of breast cancer (level III).* *Raloxifene decreases vertebral fracture risk (level Ib) and is indicated for the prevention of non-traumatic fractures. Like estrogens, raloxifene increases the risk of venous*	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

U.K. Department of Health and the Royal College of Physicians, 1999 (U.K. Department of Health, 1999)

3. TREATMENT/PREVENTION	
Arguments (U.K. Department of Health and the Royal College of Physicians, 1999)	**Comments**
thrombembolic events (level Ib). There is no high-quality (A) evidence on the prevention of hip fractures. Type (B) evidence concerns exercise, calcium in the diet or in supplements, cessation of smoking, reduction of alcohol consumption and estrogens. Evidence on etidronate and alendronate only applies to preserving bone mass (type A evidence).	

4. SCREENING PROGRAM – APPRAISAL	
Arguments (U.K. Department of Health and the Royal College of Physicians, 1999)	**Comments**
General advice on risk factors is appropriate. *Strategies to tackle osteoporosis should take into account . . . bone mineral density and many other factors, including liability to falls and types of fall, that also contribute to the risk of fracture.*	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

U.K. Department of Health and the Royal College of Physicians, 1999 (U.K. Department of Health, 1999)

Source: **Swedish Council on Technology Assessment in Health Care** (Ringertz *et al.*, 1997) Care, 1997	
Areas covered by the recommendations	
Detailed discussion on the qualities of bone density measurement as a screening method. Vague comments on the prevention of osteoporosis, nothing specific on treatment of the disease or the prevention of fractures.	
Recommendations	**General comments**
Therefore it is essential to direct preventive efforts (prevention of reduction in bone density) toward increasing activity among young, growing individuals . . . *. . . a total assessment of fracture risks in patients should include factors other than bone density alone.* *The scientific evidence is insufficient to recommend bone density measurement in mass screening of asymptomatic individuals, including mass screening of women following menopause and opportunistic screening of patients who present no symptoms of osteoporosis but who contact health services for other reasons.* *Bone density measurement may be indicated in the following situations:* *i. In patients with primary diseases which increase the risk for fracture, and for patients with vertebral fractures;* *ii. In patients with diseases that are treated by methods which increase the risk to the skeleton, e.g., prolonged cortisone therapy;* *iii. To monitor the effects of treatment for osteoporosis, assuming that this is done under controlled conditions and that tests are not repeated at intervals less than 2 years;* *iv. In research projects.*	The text counterbalances scientific arguments with practical and clinical arguments.

1. THE DISEASE	
Arguments (Swedish Council on Technology Assessment in Health Care, 1997)	**Comments**
Osteoporosis is a major, yet uncharted health problem. *With an increasing percentage of elderly people in the Swedish population, it is estimated that every second woman over 50 years of age will experience fracture at some time during her remaining life. The risk in men is lower.* *The relative risk for fracture is 1.5 times higher . . . and for hip fracture, 2.6 times higher . . . if bone density has declined to a level of 1 SD* (standard deviation) *below the bone density in healthy individuals (which is roughly analogous to the risk for stroke at a certain level of elevated blood pressure).* *Osteoporosis cannot be identified reliably at an early stage and is not able to exclude osteoporosis in healthy individuals.* *Except for vertebral fractures, . . . there is no access to treatment that can change the course of the disease in a positive direction.*	At another point in the text one reads "will probably experience fracture . . . ".

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

U.K. Department of Health and the Royal College of Physicians, 1999 (U.K. Department of Health, 1999)

1. THE DISEASE	
Arguments (Swedish Council on Technology Assessment in Health Care, 1997)	**Comments**
Bone density measurements do not provide reliable evidence that a fracture will occur at some time in the future, because low bone density values are only one of several risk factors. Most fractures result from accidents, often falls. Factors such as sight, balance and muscle strength are also major contributors toward an individual's risk for fracture.	

2. SCREENING TEST	
Arguments (Swedish Council on Technology Assessment in Health Care, 1997)	**Comments**
The accuracy of current technologies is substantially lower (10%) than their precision (97% to 99%) . . . *Bone density measurement is of major theoretic/scientific interest, but is also of commercial/economic importance. The new methods for measuring bone density may increase in practical importance as more experience is gained . . .* *. . . further research, technical development and experience are required before the methods can be introduced into routine health services.* *. . . it is not possible to reliably show differences in bone density—in the order of 1%—at intervals less than 2 years. Considering this, and the slow rate of change in bone density over time, measurements at intervals under 2 years are generally unnecessary.* *Trained staff and accurate, continuous quality control of equipment are necessary to provide bone density measurement services.* *The total annual cost per installation for bone density measurement in Sweden (approximately 80 currently in use) varies between* $10,000 and $60,000 *. . . If fully utilized, these costs will increase to between* $60,000 and $500,000 *per unit. The present cost per examination varies between* $40 and $120. *The costs for treating osteoporosis . . . in Sweden vary between approximately* $60 and $600 *per patient per year.*	These two arguments take a lucid view of the inevitable future development of this technology.

3. TREATMENT/PREVENTION	
Arguments (Swedish Council on Technology Assessment in Health Care, 1997)	**Comments**
It is particularly important to treat osteoporosis effectively, or to prevent osteoporosis from developing into a serious condition. *A deficiency in sex hormones is the strongest single factor related to reduced bone mass.*	

Appendix: Excerpts from consensus reports on recommendations regarding osteoporosis screening

U.K. Department of Health and the Royal College of Physicians, 1999 (U.K. Department of Health, 1999)

4. SCREENING PROGRAM – APPRAISAL	
Arguments (Swedish Council on Technology Assessment in Health Care, 1997)	**Comments**
. . . it is essential to direct preventive efforts toward increasing activity among young, growing individuals, and to intensify research aimed at counteracting osteoporosis. The new, specialized methods for measuring bone density play a key role in this research. *. . . a total assessment of fracture risks in patients should include factors other than bone density alone.* *Bone density measurements offer a way for measuring osteoporosis. Assessment of risk factors may contribute toward identifying persons who are particularly susceptible to fracture. Other potential signs include early menopause, heredity, previous fracture, smoking, low calcium intake, low body weight, low level of physical activity and low bone density. The presence of these risk factors, mainly in combination, may be strong indicators for treating osteoporosis.*	The two arguments in this sentence do not appear to support one another.

Appendix: Excerpts from consensus reports on recommendations osteoporosis screening

Catalan Agency for Health Technology Assessment, 1999 (Espallargues *et al.*, 1999)

Source: **Catalan Agency for Health Technology Assessment, 1999** (Espallargues et al., 1999)	
Areas covered by the recommendations	
Clinical utility of BD (bone densitometry) *as a prognostic tool to predict osteoporotic fractures. Studies on factors affecting BM* (bone mass) *alone, without further references to fracture risk were excluded.* *Identify fracture risk factors, both related and unrelated to a decrease of BM* (bone mass). No discussion of treatment.	
Recommendations	**General comments**
The available scientific evidence is insufficient to recommend BM (bone mass) *measurement in the population screening of asymptomatic persons (without previous osteoporotic fractures), including . . . menopausal women, or . . . . asymptomatic individuals.*	Puts densitometry into an overall fracture risk framework that covers risks not related to osteoporosis.
More appropriate . . . to apply BD after identifying individuals with high fracture risk (relative risk above 2 and/or relevant, consistent results): age over 70, weight loss over 10%, inactivity, corticoids, anticonvulsivants, primary hyperparathyroidism, diabetes mellitus type I, anorexia nervosa, gastrectomy, pernicious anemia, prior osteoporotic fracture. The clinical utility of BD in these groups should be determined. *Preventive measures addressed to inform lifestyle risk factors (encouraging physical activity, giving up smoking or improving calcium intake).* *Health care professionals should inform the patient on fracture risks (neurological diseases, use of psychotropes, previous fractures, visual disorders, poor health status, living away from home).* *Apply inter-sectorial measures to reduce the risk of falling at home.* *Assess the feasibility and appropriateness of bone densitometry in clinical practice for predicting new fractures.* *It would be very valuable to involve clinicians in the elaboration of recommendations for bone densitometry in clinical practice.* *More research should be carried out on certain risk factors such as alcohol intake, immobilization, dietary deficiency of vitamin D, hyperproteic diets, hepatic cirrhosis, metabolic and gastrointestinal absorption disorders.*	There is an apparent contraction between the recommendation, which is cautious with respect to high-risk individuals, and the conclusion, which clearly recommends screening, indicating the nature and number of necessary factors.

1. THE DISEASE	
Arguments (Catalan Agency for Health Technology Assessment, 1999)	**Comments**
Osteoporosis is defined as a state of excessive decrease of BM . . . and an alteration in the microarchitecture of the bone tissue, which involves an increase in bone fragility and in the susceptibility of developing fractures.	No epidemiological data provided.

Appendix: Excerpts from consensus reports on recommendations osteoporosis screening

Catalan Agency for Health Technology Assessment, 1999 (Espallargues *et al.*, 1999)

1. THE DISEASE	
Arguments (Catalan Agency for Health Technology Assessment, 1999)	**Comments**
. . . hip fracture was the most frequently studied location, which can be explained by the relevance of the social and health care consequences associated with it.	

2. SCREENING TEST	
Arguments (Catalan Agency for Health Technology Assessment, 1999)	**Comments**
The amount of equipment tripled between 1990 and 1997, and the number of examinations has increased fivefold. *The three most frequent indication reasons were monitorization of osteoporosis treatment (28%), gonadal status (basically menopause) (25%) and the radiological diagnosis of osteoporosis (19%).* *. . . .despite a low BM by BD is associated with greater fracture risk . . . considerable overlap was actually observed between baseline BM values of those who eventually suffered a fracture, and of those who did not.* *Only when an individual has a BM below 2 standard deviations of the normal value . . . is the information useful for patient management. However, this range of values is infrequent in the asymptomatic population, and so the test's yield is low.*	Therefore over half of the indications are not necessarily linked to risk factors.

3. TREATMENT/PREVENTION	
Arguments (Catalan Agency for Health Technology Assessment, 1999)	**Comments**
BD screening plus drug treatment (hormone replacement therapy) would only prevent 1 to 7% of all future fractures in currently menopausal women. *Nearly 60% of the identified fracture risk factors could not be classified due to missing information or contradictory results.* *Moderate risk factors of fracture that are associated with falls include: gender (female), smoking, low sun exposure, iatrogenic or early (under the age of 45) menopause, late menarche (after the age of 15), no breastfeeding, calcium intake under 500-850 mg/day, hyperparathyroidism, hyperthyroidism, diabetes mellitus type II and rheumatoid arthritis.* *Factors associated with fracture but not with bone mass are worth mentioning: living away from one's home, epilepsy and stroke, high-energy falls, use of psychotropes, functional capacity and morbidity, visual impairment and cognitive status disorders.* *. . . only a small percentage of the whole group presented multiple risk factors, but it was actually this group that had a high fracture rate.*	Risk factors are classified as high, moderate, negligible and unclassifiable. They are also classified in terms of whether or not they are related to bone density. Citation from Cummings *et al.*, (1995).

Catalan Agency for Health Technology Assessment, 1999 (Espallargues *et al.*, 1999)

4. SCREENING PROGRAM – APPRAISAL	
Arguments (Catalan Agency for Health Technology Assessment, 1999)	**Comments**
. . . it should be noted that a large percentage of the fracture risk factors (investigated in available studies) were only applicable to women, specifically those related to menopause and reproduction. *. . . a sizeable proportion of individuals classified as osteoporotic according to their bone mass will never suffer any fracture, but will have been labelled as fracture-prone individuals, and vice versa. This may lead to unnecessary treatments, with possible adverse effects—a fact that has ethical and economic implications.* *. . . the presence of an isolated fracture risk factor—in this case a decrease in bone mass—will probably not be a sufficient condition to produce a fracture.* *. . . the design of an effective, socially acceptable strategy for preventing fractures should not only consider a therapeutical approach, but also preventive steps and interdisciplinary efforts . . .*	

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Québec

Agence d'évaluation des technologies et des modes d'intervention en santé

ABOUT OSTEOPOROSIS AND FRAGILITY FRACTURES

What is osteoporosis?

- Osteoporosis is the result of a gradual loss of bone mass that leads to a reduction in the density and thickness of bones. It can result in serious fractures, known as "fragility fractures", which usually affect the vertebrae, hip, or wrist.

- The various consequences of these fractures include:
  - acute or chronic pain;
  - deformation of the spine;
  - respiratory and digestive ailments associated with spinal deformation;
  - disability or the loss of autonomy;
  - potentially fatal complications associated with hip factures.

A few bone mass statistics

- Starting in their thirties, women lose 0.5% of their bone mass every year.

- In the first 5 to 10 years after menopause, women lose 2% to 5% of their bone mass every year, which can mean as much as 50% over 10 years.

- Even with sufficient calcium in their diet, women can lose up to 30% of their bone mass, and as much as 50% in the vertebrae, during the 10 years following menopause.

Prevalence of osteoporosis and incidence of fragility fractures

- Osteoporosis affects one out of four women and one out of eight men aged 50 or older, which represents some 400,000 women and 125,000 men in Québec. It is estimated that half of all women in Canada over the age of 75 suffer from osteoporosis. However, osteoporosis can strike at any age, depending on the risk factors associated with the individual.

- In Canada, an estimated 76,000 fractures are attributed to osteoporosis each year, including 21,000 hip fractures. In Québec, this translates to more than 15,000 osteoporosis-related fractures, or approximately one every half hour.

- In the case of fractures of the neck of the femur, the mortality rate in the year following the accident ranges from 12% to 20%, and the disability rate among survivors is as high as 25%.

- Fractures due to osteoporosis account for more deaths among women than ovarian and breast cancer combined.

Healthcare costs

- The healthcare costs associated with osteoporosis in Canada amounted to $1.3 billion in 1993. In Québec, the cost would be more than $300 million.

- If effective action is not taken to prevent osteoporosis, it is estimated that Canada will spend at least $32.5 billion on treating osteoporotic fractures over the next 25 years. This figure will likely climb with the aging of the population.

Risk factors

- Three factors are considered particularly interesting, because they are associated with the risk of both osteoporosis and fractures: a history of fragility fractures; physical inactivity; and a low body mass index.

- Other easily modifiable risk factors include smoking, inadequate exercise, a diet with an insufficient intake of calcium and vitamin D, and excessive consumption of alcohol, coffee, tee, cola, and salt.

- The removal of the ovaries, early menopause (before age 45), irregular menstruation, and the prolonged use of certain drugs such as heparin, corticosteroids, and thyroid hormones, also rank among the risk factors which can be assessed by a treating physician.

- Québecers are especially at risk of incurring fractures and osteoporosis due to geodemographic factors: a primarily white population; less exposure to sunlight (shortage of vitamin D); less physical activity due to confinement during the winter months; and the greater risk of falls in icy weather.

Detecting osteoporosis

- Osteoporosis is often described as a "silent thief", because the loss of bone mass occurs without symptoms. The onset of the symptoms, which include pain, reduced height, and marked curvature of the spine, often associated with a fracture, indicates that the disease is already at an advanced stage.

- There is no completely reliable method of detecting osteoporosis. Bone densitometry, which uses x-rays to measure the amount of bone tissue in the lower spine and hip, is currently the only diagnostic method that is officially recommended by the World Health Organization, even though this technique is less than perfect. However, there is no universally recommended method of detection.

- At the present time, knowledge of the risk factors and prevention remain the best weapons against osteoporosis.

Treating osteoporosis

- Although they are essential, because the body's natural ability to absorb calcium declines with age, calcium supplements alone are not enough to prevent the disease from developing.

- The use of drugs is presently the means preferred by doctors for curbing the loss of bone mass, augmenting it, and reducing the risk of fractures.

- Physical exercise and a healthy diet remain excellent means of preventing the occurrence of osteoporosis in those who are not already in the high-risk group.

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